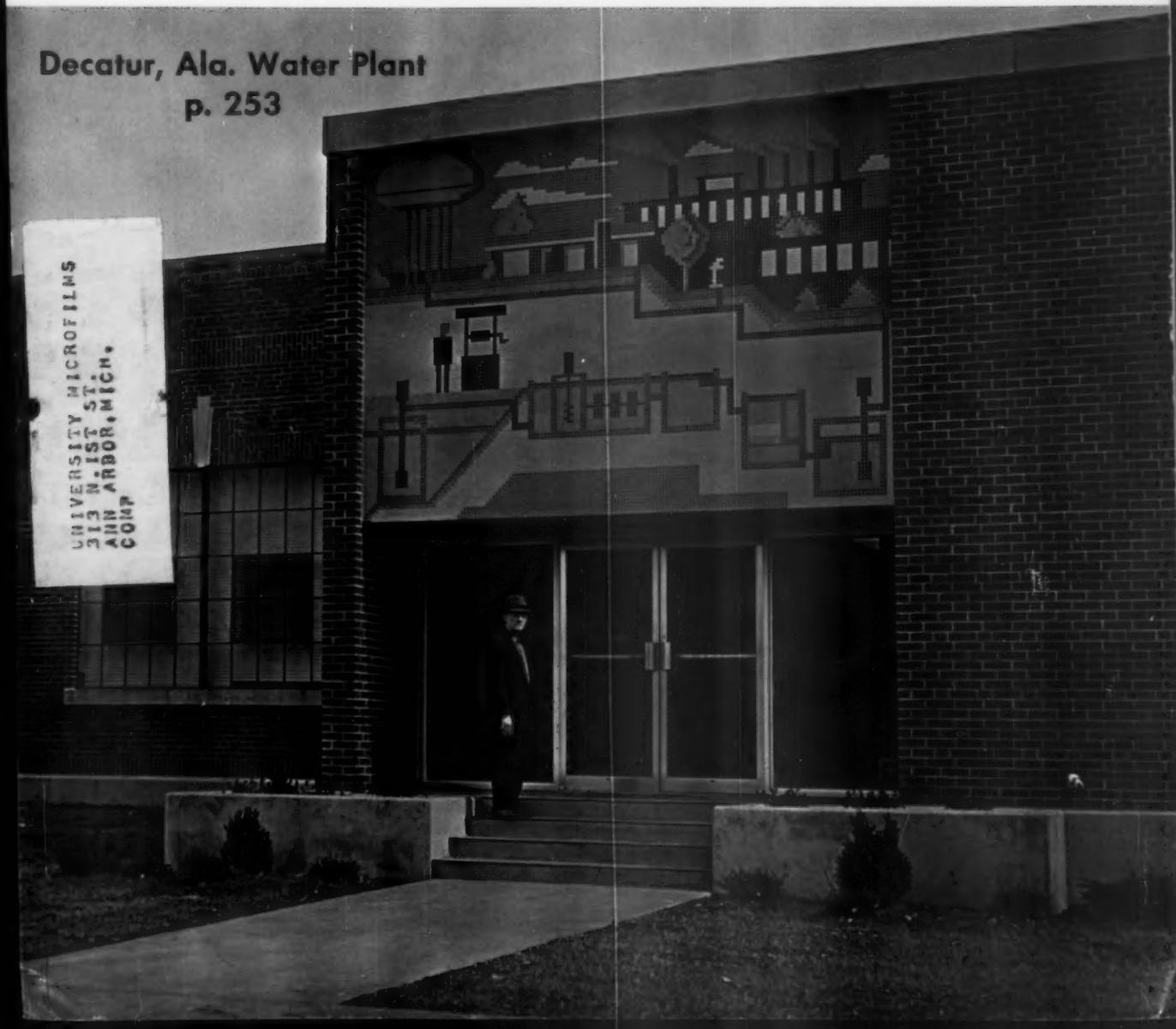
A Scranton Gillette Publication

JULY 1960

WATER & SEWAGE WORKS

WATER SUPPLY • SEWAGE DISPOSAL



Decatur, Ala. Water Plant
p. 253

UNIVERSITY MICROFILMS
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ANN ARBOR, MICH.
COMP

The purchaser of Lock Joint Concrete Pressure Pipe gets his first pleasant surprise at the reasonable initial cost of the product; his second at the ease and economy with which it can be installed. But long after the pipe has been buried and forgotten, it demonstrates even more graphically its saving ways. Because of the pipe's extreme durability, replacement costs are virtually non-existent. Maintenance requirements are so negligible that savings on repairs during the pipe's useful life span of more than 100 years may easily represent a substantial portion of the line's initial cost. Its permanent high carrying capacity cuts pumping charges to the bone and eliminates costly periodic cleaning of the line. In every way Lock Joint Concrete Pressure Pipe not only provides economies for the purchaser, but continues to pile up savings year after year, for generations.

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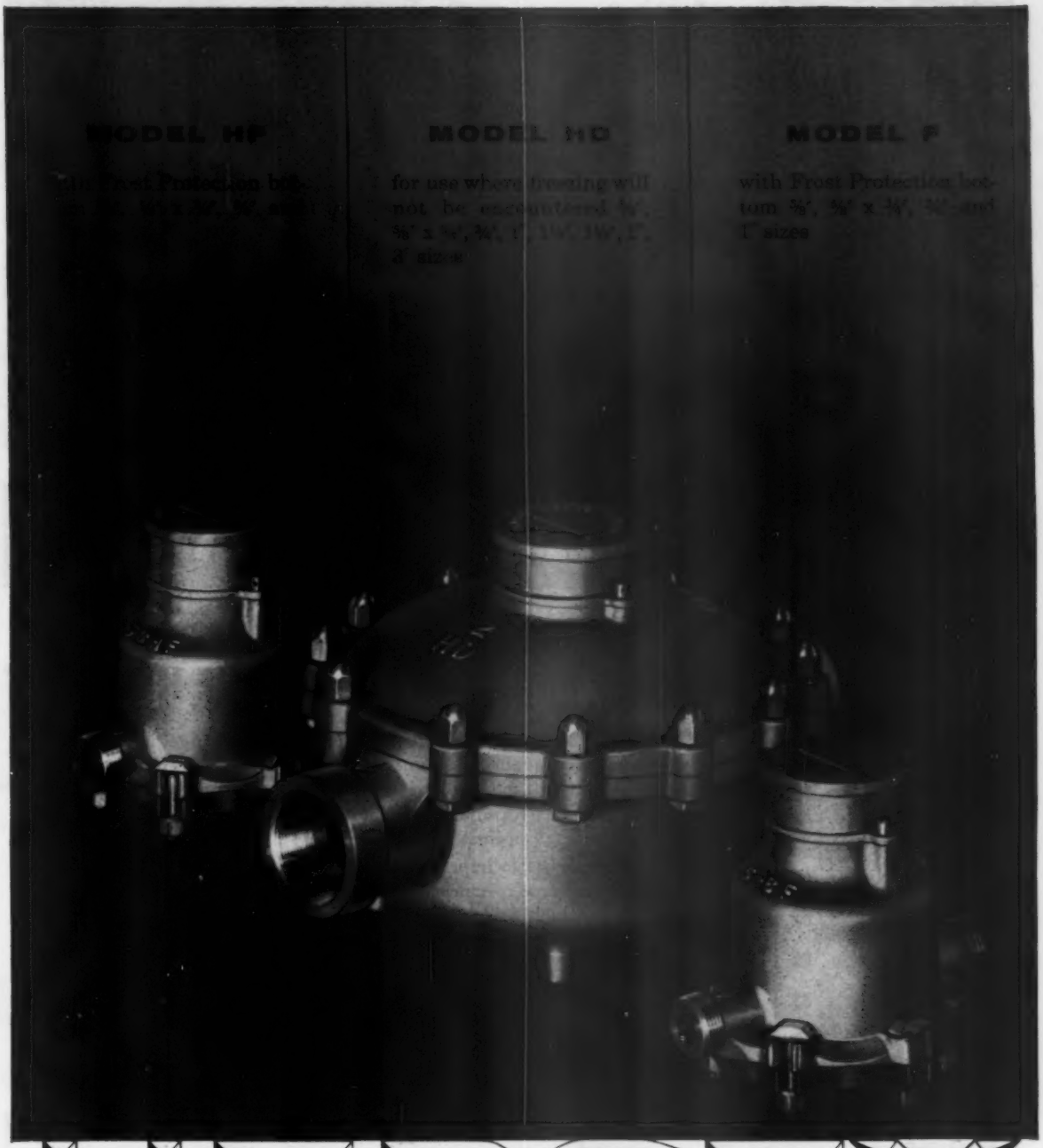

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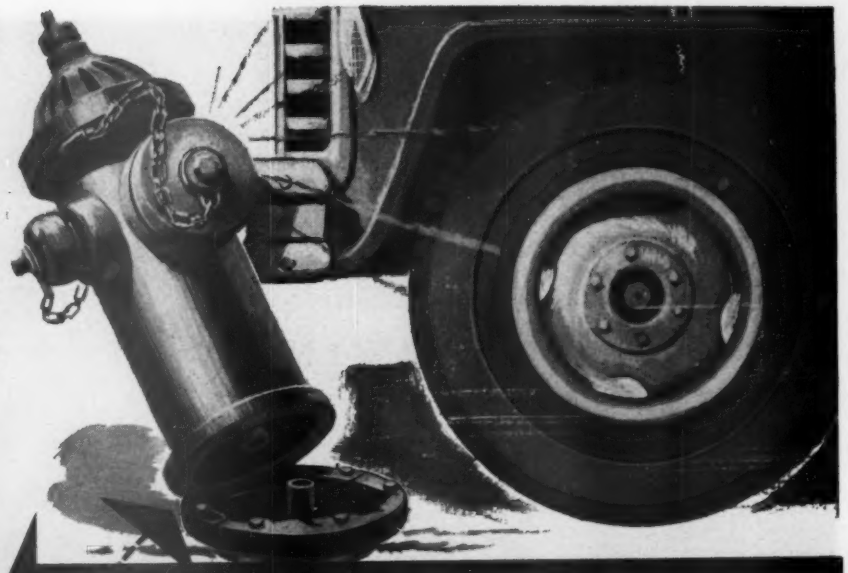


THIS DEMONSTRATION

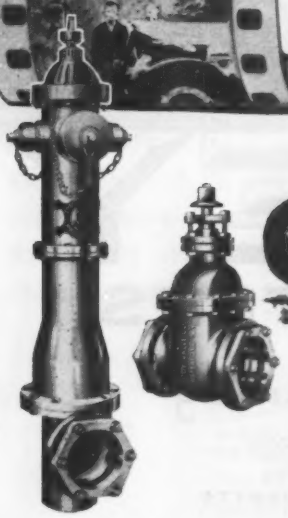
...proved the advantages of

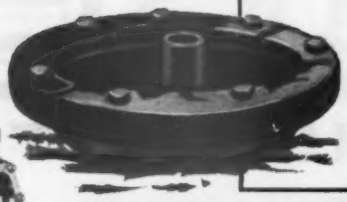
THE NEW EDDY BREAK-FLANGE HYDRANT

• Clean breaking action of the new EDDY break-flange hydrant is clearly demonstrated in this film strip of a test made recently for Mr. Herbert Campbell, Town Engineer, Wayne, New Jersey. Just as it was designed to do, the hydrant broke off at the break-flange and the coupling sheared at the weak point.

Mr. Campbell was so impressed that he changed the specifications on the spot...wrote new specifications around the EDDY Hydrant. Another EDDY feature which appeals to economy-minded waterworks officials is that these hydrants, with the break-flange feature, are the same as standard EDDY models in all other respects. Working parts are interchangeable and no separate inventory of repair parts is required.

We'll be glad to help you arrange a similar demonstration.
It pays to standardize on EDDY hydrants and valves.





NO HARM TO HYDRANT...

As shown, the safety stem coupling shears off at the ground line. The break-flange gives way without damage to stand pipe or nozzle sections. With break-flange construction the hydrant is easily and economically replaced without digging or costly repairs.

EDDY VALVE COMPANY
A Subsidiary of James B. Clow & Sons, Inc.

WATERFORD NEW YORK

Vol. 107 No. 7
JULY • 1960

A Scranton Gillette Publication

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P.F.T.-Pearth system for scum control.

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Briefs

Decatur, Alabama's Water System is a good example of a modern facility that has kept up with the problem of providing enough water for a continually expanding community—Page 253.

Illinois Section A.W.W.A. featured discussions on demand rates, sewer service charges, water utility advancement, treatment and operator problems—Page 256.

New York Section A.W.W.A. (at Binghamton)—Approximately 300 members and guests attended the meeting which was capped by the dedication of the city's new Webster St. Water Treatment Plant. The papers presented at the meeting stressed the problems and techniques encountered in the management of water supply systems—Page 260.

Dedication of Binghamton's New Water Filtration Project was a gala affair that coincided with the Spring meeting of the New York Section A.W.W.A.—Page 262.

Second Sanitary Engineering Conference, Part I—Radiation and the effects of radioactivity on man and his water supplies were the subjects discussed at this meeting. Part I considers radiation and how it affects man and his environment—Page 265.

Passed by Degrees—Another adventure with "Partially Oriented"—Page 268.

Linear Output Flow Meter—This article describes a device for indicating water flow by direct readings—Page 269.

Our Changing Environment makes it imperative that we be ready to develop new and radical techniques if we expect to continue making progress in the field of public health—Page 273.

Calcite Coating Protects Water Pipes (A Research Progress Report)—The author describes a practical means to insulate pipe from corrosion attack through the careful control of calcium carbonate and polyphosphate content.—Page 276.

West Virginia's S.I.W.A. adopted a new name and their meeting featured a special Operator's Forum on treatment problems. The State's A.W.W.A. section heard at their meeting pertinent papers on water supplies, quality and related equipment—Page 282.

A New Method for Calculating K and L for sewage presents some novel thoughts in the mathematics of an interesting phenomenon—Page 285.

Denver's Sewage Disposal Problem is complicated by a multiplicity of small sewage districts. In its metropolitan area, 57 sanitation authorities operate 26 treatment plants. The plans for solving this problem are presented on—Page 287.

Hammond, Indiana, taking its cue from the National A.W.W.A. slogan, "does it now" by keeping abreast of its water supply requirements in a progressive manner—Page 291.

Where Do We Go From Here? and **Calcite Coating** are editorials discussing matters of immediate importance in the water works field—Page 292.

KILLS
PSYCHODA FLIES
in trickling filters

FORMULA R.S.C.
breaks the barrier of resistance for effective, sustained control of Psycheda flies in human and industrial wastes treatment plants.

kills flies, larvae and pupae

without damage to zoogleal film

without destroying beneficial bacteria

without reducing filter efficiency

NEW INHIBITORY FACTOR—Hundreds of tests have demonstrated that R.S.C. is extremely effective in killing Psychodae which have shown high degree of resistance to DDT, Methoxychlor, Lindane, Chlordane, Dieldrin, Aldrin, Malathion and other insecticides.

This is accomplished by an inhibitory factor which renders a hitherto resistant fly susceptible to the insecticides in the R.S.C. formula. Field tests in such widely separated areas as Illinois, Texas, Florida have shown that use of R.S.C. reduces filter fly population to practically nil.

EASY TO USE—Dose with R.S.C. liquid concentrate through primary effluent and spray surrounding surfaces to kill flying adults.

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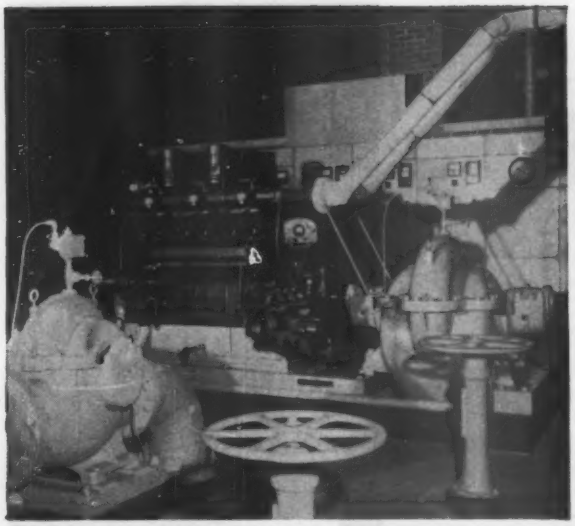
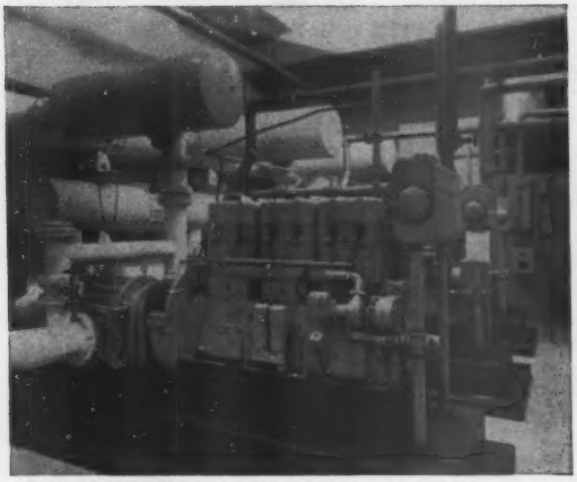


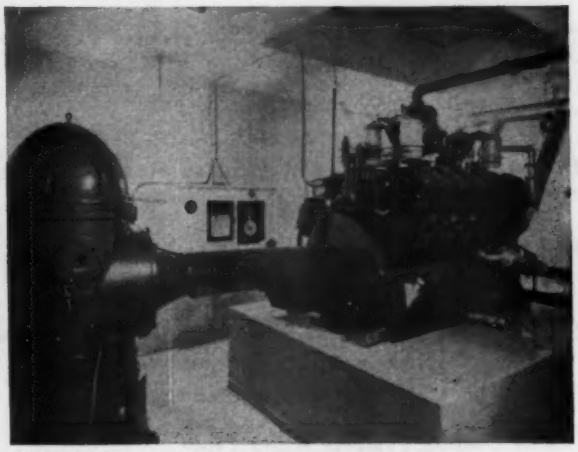
EAST—North Stamford, Connecticut—water pumping system.



MID-CONTINENT—Waste disposal power in Enid, Oklahoma.

All over the country, municipal and utility plants use ROILINE engines in water supply systems, waste disposal services, and for power generation. Operating on natural or LP gas, or gasoline, ROILINES have been standard in the field for many years.

ROILINE ENGINES



WEST—Rivera, California—deep well pumping power.

NATURAL GAS RATINGS					600	800	1000	1200	1400	1600	1800	2000	2200	2400
MODEL	Bore & S.	Cyls.	Displ.	Torque–rpm	BRAKE HORSEPOWER AT ENGINE SPEEDS INDICATED									
H570	4⅜ x 4¼	8	570	457-1400	...	68	86	104	122	139	156	172	188	198
H884	5⅜ x 4⅞	8	884	710-1400	...	105	133	162	189	216	241	261	273	282
F1500	6¾ x 7	6	1503	1090- 600	125	165	200	215						
H2000	6¾ x 7	8	2004	1490- 650	170	225	270	290						
L3000	6¾ x 7	12	3006	2200- 700	250	335	405	435						
L3460	7¼ x 7	12	3468	2500- 900	285	380	474	555	592 @ 1350					
L4000	7.54 x 7.5	12	4000	3020- 600	345	447	550	635						

With oil pump, water pump, magneto, air cleaner, carburetor, and exhaust muffler. Hp shown is maximum.

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News—Here & There

Kehr Leaves MSD for PHS Position

The resignation of William Q. Kehr, executive director of the Metropolitan St. Louis Sewer District since 1955, was announced by Frank L. Ramacciotti, chairman of the board of trustees. Mr. Kehr's departure, effective July 1, will enable him to take a position with the United States Public Health Service in Washington, D. C.

Before joining MSD, he was on assignment as Assistant Basin Engineer for the Pacific Northwest drainage area, which then included six states and Alaska. Previous to that, he spent fourteen years with the Missouri Division of Health in charge of its water pollution control program. In his new position with PHS, he will be engaged in water pollution control duties.

When making the announcement of Kehr's resignation, Ramacciotti expressed that "the board was sorry to see Mr. Kehr go. Much of the progress that MSD has made in the last five years is due to Mr. Kehr's conscientious service. We believe we speak for the entire St. Louis community when we express our thanks to him for a job well done."

Kehr's letter of resignation reviewed the progress made by the utility during since its inception and expressed his gratitude for the cooperation he had received during his tenure as its executive director.

Unusual Water Short-Course Held by U. of Ill.

Probably the first of its kind, an unusual engineering short course on evaluating water wells and aquifers was conducted May 10-11, at the University of Illinois, Urbana, by the Engineering Section of the Illinois State Water Survey in cooperation with the University's Engineering Extension Division.

The two-day course attracted 67 engineers and specialists of five different states, who represented industries, consulting engineering firms, and federal and state agencies.

As a series of lectures and problem sessions, the short course reviewed methods of analysis in ground-water hydrology employed by the Illinois State Water Survey. The subjects covered were analysis and interpretation of pumping test data, including non-steady state flow, boundary conditions, and sustained yield.

William C. Walton, head of Ground-Water Research, and Harman F. Smith, head of Engineering Section of the Illinois State Water Survey, were in charge of the program. Professor Robert K. Newton of the University of Illinois coordinated the program for the Extension Division.

An Addendum

We would like to add a credit line inadvertently omitted in the May issue of WATER & SEWAGE WORKS. In regard to Kenneth F. Knowlton's and Russell H. Babcock's article, "Investigation of Liquid-Alum Flow Measurement", we should have given credit to the New England Water Works Association for allowing us to use the information contained in the article.

Wanted—Sanitary Engineer

The Air Materiel Command, U.S.A.F., at the Wright-Patterson Air Force Base, Ohio, is in need of a qualified applicant to fill a vacancy as Sanitary Engineer; the salary is $8,810 per annum.

Applicants who have had extensive professional experience in the operation and maintenance of industrial waste and sanitary sewage treatment facilities, may send an application (Standard Form 57) to the Employment Branch, Attn: MCGC-EA, Wright-Patterson Air Force Base, Ohio.

Pulling In A Big One

You can tell by the smile that Paul Weir, General Manager, Atlanta, Ga., Water Dept., has hooked a real prize

and is anticipating telling the folks back home. Paul's "haul" took place during a fishing trip made while he and companions attended the A.W.W.A. convention at Bal Habour last May.

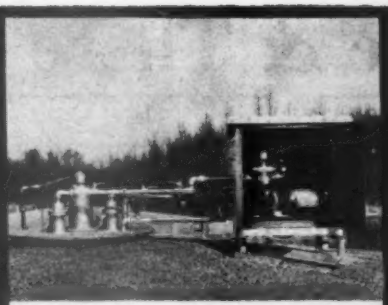
Water and Sewage Works Research Progress Reports

Appearing this month on page 276 is the first in a series of Water and Sewage Works Research Progress Reports. Believing many of its readers want to be up-to-date on current research, Water and Sewage Works has invited USPHS Research grantees to submit reviews of their work and reports of progress. The reports cover a wide area of science basic to water resource conservation, pollution control, analytical methods and water and waste water technology.

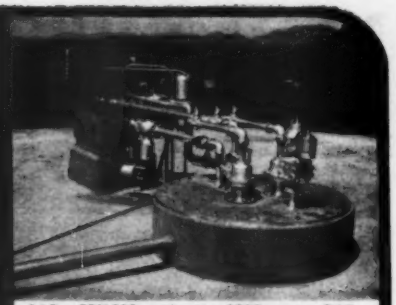
In addition to these progress reports, we hope to keep our readers advised of new grants, reports of research having practical application and reports of research programs supported by means other than USPHS. Readers conducting their own research programs are also invited to submit reports for consideration by our editors.

Comments on these reports will be welcome, and specific comments directed to authors will be referred to them for appropriate action.

ROCKFORD, ILL.—Three GASLIFTERS in existing digesters. Henry Riedesel, Mgr., San. Dist. Greeley and Hansen, Chicago, Cons. Engrs.



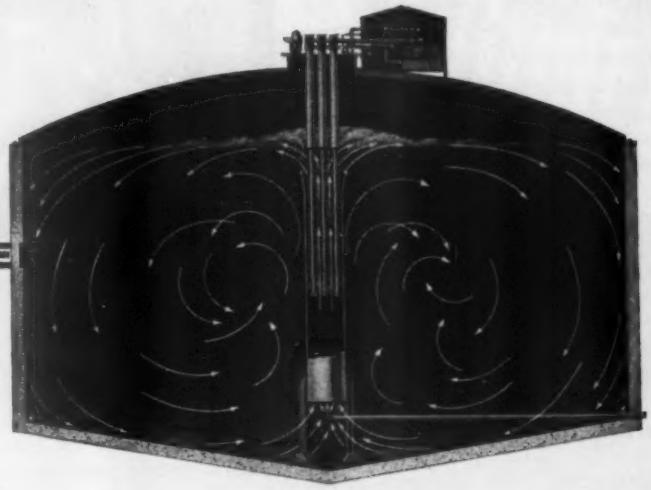
GREENSBORO, N. C.—GASLIFTER in existing 75' dia. digester with floating cover. Dan Holder, Supt. City of Greensboro, Engrs.



LAS CRUCES, N. M.—8000 gpm GASLIFTER in 50' dia. digester with fixed cover. R. A. Smith, Supt. Gordon Herkenhoff & Assoc., Albuquerque, Cons. Engrs.

GASLIFTER

DIGESTER CIRCULATOR - MIXE



GASLIFTER is a trademark of Walker Process Equipment Inc.

GASLIFTERS incorporate the patent right of Joseph Cunetta.

NO INACTIVE ZONES—permits utilization of entire digester capacity allowing higher loading rate.
IMPROVES OPERATION—circulates and mixes digester contents and insures uniform distribution of raw and seeded sludge.
CONTROLS START-UP—avoids start-up troubles by completely homogenizing contents; induces rapid gasification and volatile acids remain low.
ELIMINATES SCUM BLANKET AND GRIT SHOALS—circulation velocity at roof, sides and floor disperses grease blanket and bottom shoals.
EASY INSPECTION—exclusive locking chamber permits individual inspection and servicing of GASLIFTER sparging units without dangerous gas loss or digester shutdown. Eductor Tube, Gas-Lift principle avoids mechanical troubles from rag and "sewage string" fouling.

SACRAMENTO COUNTY, CALIF. (San. Dist. #3) GASLIFTER in 70' dia. digester with fixed concrete cover. Mr. Norman Farnum, Supt. Dewante & Stowell, Sacramento, Cons. Engrs.

SALT LAKE COUNTY, UTAH—(Suburban San. Dist.)—12,000 gpm GASLIFTER in 60' dia. digester. Emil Meyers, Supt. Caldwell, Richards & Sorensen, Inc., Salt Lake City, Cons. Engrs.

AURORA, ILL.—10,000 gpm GASLIFTER in existing 50' sq. digester. Williard P. Pfeiffer, Supt. W. E. Deuchler, Assoc., Inc., Aurora, Cons. Engrs.

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WATER
for generations to come

Our nation's population growth requires water—clean water, and lots of it! Controlling pollution of lakes, streams and rivers means better public health and water supplies, new and improved vacationlands abounding in fish and wildlife. Local industries also benefit from unpolluted water supplies. Up-to-date sewage treatment facilities insure these continuing benefits. The following cases show actual benefits achieved by planned water pollution control.

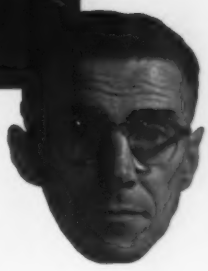
Everybody benefits from clean water

Abundant usable water is every American's birthright—and responsibility! Modern living takes good water away...modern technology alone can restore it.

Clean, sparkling river water flowing into Wyoming's Glendo Reservoir makes it a great place for water sports!

The Glendo Reservoir on the North Platte River was ideal for recreation except for the untreated sewage being poured into the river by every town for 100 miles upstream. Then they all joined in a highly successful clean-up campaign. Ridding the river of dangerous wastes not only took care of a serious public health problem—it gave everyone a delightful new recreation attraction after the dam was built. Boating, swimming and fishing bring many vacationers to the area each year.

"They're catching bass in the Walnut River for the first time in 35 years!" say local fishermen. Oil field, refinery and municipal wastes spoiled one of the prettiest rivers in southern Kansas. But the communities and industries along the Walnut River set up a *pollution abatement program* and each cooperated to carry it out. They've built new sewage treatment plants, eliminated oil field brines and set up waste treatment facilities at refineries. The river is being returned to its original beauty—a natural resource to be proud of!



"Our water clean-up brought us new industry and jobs," says Mayor J. E. Keech, Cumberland, Maryland. The city built a new sewage treatment plant (above) that will take care of all home and factory wastes, even with the growth expected in the next ten years. And that's one important reason Pittsburgh Plate Glass Company came to Cumberland! Their new factory will bring jobs for nearly a thousand people.

Right next door to luxury homesites . . . treatment plant doubles as popular marina!

An attractive and useful asset to the community is the sewage treatment plant at Clearwater, Florida. Its appearance would do credit to a fine yacht club. There are 45 boat slips for public use at the Marina Station. Planned for the future, the plant's capacity for treating wastes will be more than adequate for the population expected when the area is fully developed.

Treatment plant on a boulevard wins favor for engineers and city officials

The Coral Gables, Florida, sewage treatment plant is truly a civic showplace. Walls are decorated with colorful scenes by famous artist John St. John. A well-designed, odor-free treatment plant is a credit to a community wherever it's located!

HERE'S HELP IN GETTING PUBLIC SUPPORT FOR ACTION ON POLLUTION PROBLEMS IN YOUR AREA

The pages you have just read relate a story that needs telling to the public. That's why PCA is reprinting this colorful insert—with a new fourth page—folded for easy mailing (shown at right.)

This mailing piece is available in quantity for use locally where help is needed to inform the public as to the urgency for obtaining adequate pollution control facilities.

For further information about this folder, or for help of any kind in planning your clean-up programs—just call on PCA.

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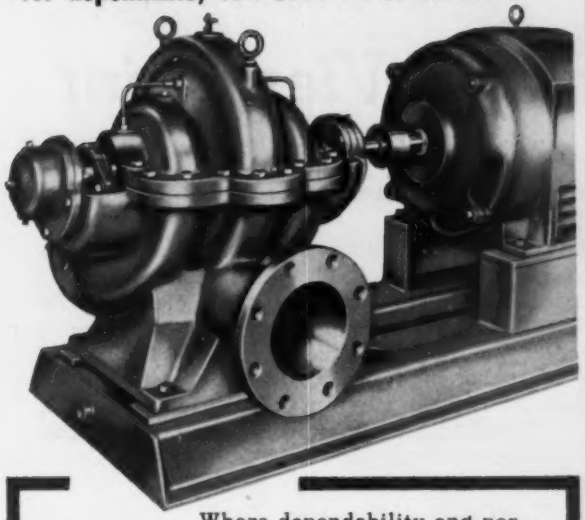
A national organization to improve and extend the uses of concrete

WEINMAN PUMPS

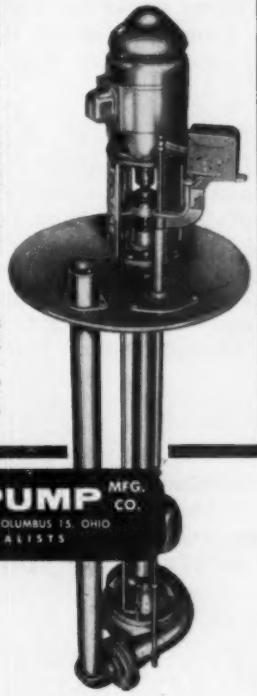
for dependable, low-cost water service...



Where dependability and performance count most—at critical pumping stages of water movement—you'll find Weinman Pumps. There's good reason for it, too. Weinman Split-Case Centrifugal Pumps are precision built to function continuously at top efficiency, with little or no maintenance. The horizontally split casing speeds routine maintenance and increases the "in-service" time of Weinman Pumps. Rotating parts are quickly inspected and easily removed or replaced without disturbing connections or driver. And, the rugged construction of Weinman Pumps stands up under the grueling punishment of 'round-the-clock operation. Municipal engineers and taxpayers alike benefit from the real economy of Weinman's dependable year-in, year-out trouble-free on-line service.

And, you get the same uninterrupted, dependable service from Weinman's outstanding line of Sewage Ejectors for the swift handling of liquids of varying viscosities carrying all types of foreign matter in suspension.

Write today for full information on all Weinman Centrifugal Pumps and for the competent, on-the-job assistance of your local Weinman Specialist, check the Yellow Pages.



THE WEINMAN PUMP MFG. CO.
290 SPRUCE STREET COLUMBUS 15, OHIO
CENTRIFUGAL SPECIALISTS

MEMBER

engineered performance + and economy +

IDEAL

+

Originally purchased for use as a spare in the City of Cleveland's Fairmont and Division Street Pumping Station, this IDEAL 1750 HP synchronous motor remained in operation as an integral part of the city's water supply system after final acceptance tests were completed.

Without the necessity for modification of the existing mounting base, this bracket-bearing unit replaced a pedestal-type motor, permitting substantial savings in installation and replacement costs. In addition, IDEAL patented sleeve bearings, located in the air intake system of the motor, operate at temperatures approximately 20° F cooler and affect considerable reduction in lubricating oil requirements. When you select IDEAL custom-designed motors, you can expect essentially lower installation and maintenance costs with true operating economy—for years to come!

+

Write for bulletins 501 and 502 or contact your nearby IDEAL representative for engineering or application assistance.

The +

IDEAL ELECTRIC

& MANUFACTURING COMPANY

337 East First Street Mansfield, Ohio

SINCE 1903, MANUFACTURERS OF PRECISION MOTORS, GENERATORS, MOTOR-GENERATOR SETS, SWITCHGEAR AND CONTROLS

Washington Viewpoint

A lot of people were surprised—though they shouldn't have been—when Congressman Joseph Martin (R. Mass.) used the podium of the National Rivers and Harbors Congress to protest the President's veto of added funds for pollution control (HR 3610), urged delegates to support similar action in the next Congress. Said Martin: "The legislation (increasing pollution funds from $50 million to $90 million annually) was vetoed and the veto sustained. This has not...eliminated the problem. Pollution...will not go away by itself." Reason for no surprise: Martin—longtime Republican House leader—was one of the few Republicans who voted to override the veto.

☆ ☆ ☆

Although Chicago's hopes of additional diversion of Lake Michigan water into the Illinois Waterway seem safely sidetracked at least until next year, the city's Congressmen are still trying. Latest move was an attempt by two Chicago legislators (O'Brien and Yates) to tack a rider on appropriations for the Department of Health, Education and Welfare, authorizing a $12 million study of pollution in the Great Lakes—with special authorization for the Chicago Sanitary District to divert an added 1,000 cfs as a part of the study. The move was immediately characterized as a "Trojan Horse" maneuver by Congressmen from other Lakes states, who saw it as an "end run" to get around current considerations of the problem by the Supreme Court and the Senate Foreign Relations Committee.

☆ ☆ ☆

A total of 100 billion gallons of water per day—nearly triple present demand—will be the aggregate U.S. industrial demand for water by 1980, according to Department of Commerce estimates prepared for the Senate's Select Committee on National Water Resources. And on top of that, the mining industry will need a total of 10 billion gallons per day in the same year.

☆ ☆ ☆

The Atomic Energy Commission is breathing easier about its sea disposal sites, after a survey of a relatively shallow disposal area in Massachusetts Bay, used for a seven-year period. A survey, just completed, has "not revealed any radioactivity attributable to the disposal operations", said AEC (the area has been abandoned in favor of deepwater basins off the continental shelf). But, carrying on its own checking program, AEC also announced that eight state and federal groups are now participating in a study of the Clinch River, downstream from Oak Ridge, Tenn., concerning health and safety aspects of release of low-level radioactive waste solutions to the river.

☆ ☆ ☆

As expected (see June column) Congress approved and the President signed a new law that directs the Public Health Service to study the effects of motor-vehicle fumes on human health. PHS must make a report to Congress within two years. Most observers in Washington think the new measure will be forerunner to federal legislation giving the Surgeon General broad new powers to act against air pollution sources.

☆ ☆ ☆

Small, on-site sewage treatment plants—not septic tanks—are the best answer to the problems of rapidly-growing rural areas near big cities. Legislators of

suburban Maryland and Virginia counties heard that advice from state health authorities at a recent meeting. Maryland Public Health Engineer W. M. Bingley told county authorities that such small plants might still dump incompletely treated sewage into streams—but added that this would be preferable to contamination of the water table with raw sewage from septic tanks.

☆ ☆ ☆

Attitude of voters toward bond issues for public improvements gave officials of Arlington, Va., a nasty shock, when voters turned down a $7.8 million issue, which included new storm drainage and other water and sewer improvements. Within two weeks, the same voters resoundingly approved a $26 million school bond issue. The shock needn't have been so bad—if officials had been watching statistics gathered monthly by the Investment Bankers Association in Washington. These have shown a consistent pattern, over the past year, of voter skepticism on all spending, except for schools. Problem, say bankers, is that many taxpayers will increase their burdens for education, but aren't convinced other improvements are immediately necessary—which would indicate a major publicity job for pollution control advocates.

☆ ☆ ☆

That preliminary report of the Supreme Court's Special Master into states' rights to Colorado River waters was a real upset for Californians—who'll try to minimize the effect by legislation, if need be. What the Special Master has said, in effect,is that the Colorado River Compact affects the river from Lake Mead to the Mexican border—but does not affect the stream above the federally-built lake. Thus Arizona and Nevada may divert waters of Colorado tributaries above the lake, without affecting their rights to shares of water below the lake. It's a major blow to California's hopes to get 5,326,000 acre-ft of water annually (vs about 4.4 million now) for use at Los Angeles and other southern California cities.

But Californians—and most westerners—marked it as good news when Congress surprised many and put through authorization for the huge ($2.2 billion) San Luis project, which will bring water from the northern part of the state to the central and southern areas. For the first time, the law now permits federal-state partnership in construction and operation, with California putting up $1.7 billion (if voters approve a bond issue in November, the U.S. putting up an additional $290 million. Main interest is irrigation—but approval of the plan to switch water from one watershed to another 400 miles away, is considered a milestone.

☆ ☆ ☆

You can tap the Bureau of Reclamation's 50-year dam-building experience, via a $6.50 booklet "Design of Small Dams", now available from BuRec's Federal Center at Denver, Colo. (Attn: 841). The 611-page volume will (1) provide engineers with information and data necessary for proper design of small dams; (2) specialized and highly technical knowledge concerning the design; (3) simplify design procedures for small earthfill dams—according to BuRec.

☆ ☆ ☆

Western Congressmen—aside from their view of the water problem as a good political wagon to have in their train—are concerned enough about potential water shortages to want to expand present saline-water conversion programs. Latest is Senate Majority Leader Lyndon Johnson, who's introduced a bill to expand the program by nearly tripling present roughly $3.5 million a year appropriations for the Office of Saline Water.

☆ ☆ ☆

Associated General Contractors wasted no time in unleashing a barrage of figures to prove the opposite, after National Association of Plumbing Contractors released a new brochure extolling the virtues of separation of contracts. Said AGC President John A. Volpe: "NAPC has consistently rejected cooperation with other industry organizations...instead is unilaterally promoting separate contracts to the detriment of the entire construction industry." He then proceeded to refute, point-by-point, NAPC claims that nine specific jobs showed cost savings to owners through separate contracts for plumbing and other mechanical trades.

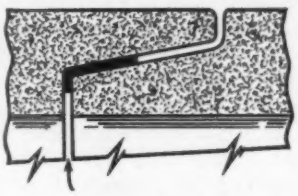
There's a quick-coupling, leak-proof, acid-resistant

TYLOX® *flexible* GASKET

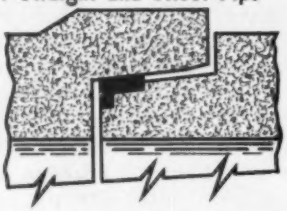
for any type of concrete pipe sewer line you plan or build

Are your files up to date on the *full line* of Hamilton Kent TYLOX Gaskets? Whether you are planning lines using T & G, B & S, Offset or Recessed Pipe, there's a special TYLOX true compression Gasket, in either rubber or neoprene, to assure fast pipe-laying and make the joints water-tight and acid-resistant for the life of the pipe itself. Check this list, and write for the TYLOX Data Brochures needed to make your reference files complete:

TYPE "C" and "C-P" TYLOX for Straight and Offset Pipe

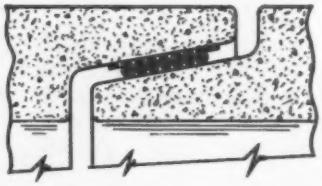


Type "C" Tylox under full compression. Note the visual inspection feature.



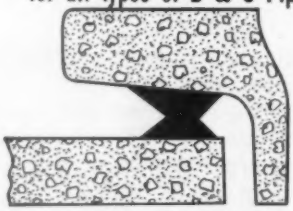
Type "C-P" Tylox under full compression. Flanges "lock" Gasket in proper position on the pipe offset.

TYPE "A" TYLOX for T & G Pipe



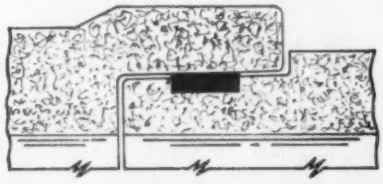
Type "A" Tylox under full compression on standard T & G Concrete Pipe.

TYPE "K" REXON for all types of B & S Pipe



Rexon "K" under full compression. Types available for both heavy and light duty service.

TYPE "CR" TYLOX (for Recessed Pipe)



Tylox Type "CR" under full compression. Wide, flat design makes "CR" roll and twist-proof.

USE THIS COUPON TO WRITE FOR MORE INFORMATION ▼

5152-3

HAMILTON KENT MANUFACTURING COMPANY
KENT, OHIO
427 West Grant St. ORchard 3-9555

Please send data brochures on the following Tylox Gaskets:
Type "A" ☐ Type "C and C-P" ☐ Type "K" Rexon ☐ Type "CR" ☐

Name_____
Firm_____
Position_____
Address_____
City_____ Zone____ State_____

CANADIAN DIVISION: 3194 Mavis Rd., Cooksville, Ontario, ATwater 9-3671

Equipment News

Coagulant Aid Tested

701

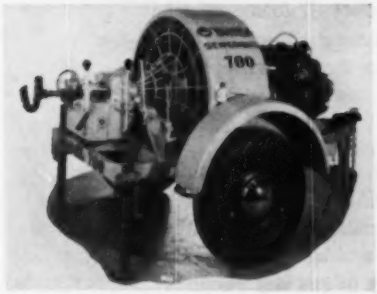
Illinois Water Treatment Company, Rockford, Illinois, has announced that their coagulant aid, ILLCO IFA 313, was recently reviewed by the Public Health Service's Technical Advisory Committee on Coagulant Aids for Water Treatment. On the basis of information submitted by the manufacturer, the Committee concluded that this product can be used for treatment of public water supplies with no adverse physiological effect upon water consumers, when used in the recommended concentrations of 10 parts per million or less, and provided the quality specifications furnished to the Committee continue to be met.

The Committee emphasized that its findings bear only on the health aspects of the use of this product and do not constitute endorsement or indicate effectiveness in proposed use.

Sewer Cleaning Machine

702

O'Brien Manufacturing Corp., Chicago, Ill., is offering its Model 700 Sewerking, a sewer cleaning machine that is capable of rodding sewer lines as much as 700 feet.



The unit can be used both as an integral part of a preventive maintenance program and for threading for bucket machines.

Universal Indicating Transmitter

703

The Foxboro Company, Foxboro, Mass., has just introduced a new line of pneumatic indicating transmitters for pressure, flow, temperature, liquid level, differential pressure, and dew point.

Known as the Model 45 Series, the new line features measuring elements specifically designed for each major process variable. The transmitter is available with measuring elements in the following ranges: Pressure, 0-10 inches water 0-80,000 psi; Temperature, 450F to +1000F (−270C to +500C); Flow (differential pressure), 0-1 to 0-400 inches water; Liquid level, open vessels 0-10 inches water minimum; closed vessels, 0-20 inches water minimum; and Dew Point, −50F to +165F. Its output signal is 3-15 psi (3-27 psi optional). It operates on a 20 psi air supply.

The new transmitter has high ambient temperature stability, with less than ½ percent error for ambient temperature changes as great as 50F, regardless of the variable measured. Overall calibrated accuracy of the transmitter, including measurement and output signal, is guaranteed by

CONTINUED ON PAGE 19A

PACIFIC
A TYPE FOR EVERY SERVICE
RUGGED — DEPENDABLE
NON-CLOG
SEWAGE PUMPS
DRY PIT - WET PIT
SUBMERSIBLE
HORIZONTAL
CHOICE OF IMPELLERS
NON-CLOG DRY PIT pump with double suction elbow and stand. Send for Bulletin 1850.5.
NON-CLOG WET PIT with cover. Single unit. Duplex models with alternating controls available. Send for Bulletin 1850.2.
PACIFIC NON-CLOG PUMP with motor, motor support bracket, suction elbow and stand. Send for Bulletin 1850.5.
HORIZONTAL NON-CLOG MODEL with flexible coupling. Send for Bulletin 1850.5.
Outstanding performance and long trouble-free service from every type.
Pacific Non-Clog Sewage Pumps combine all desirable design features that assure efficient, economical and dependable operation and service.
Order now. ALL TYPES AVAILABLE FOR IMMEDIATE SHIPMENT.
SUBMERSIBLE NON-CLOG
A complete unit ready to install includes pump, motor, automatic controls and cable to control panel. Send for Bulletin 1850.5.
PACIFIC PUMPING CO.
Established 1907
Manufacturers and Distributors of Pumps for Every Service
MAIN OFFICE AND FACTORY: 9301 San Leandro St., Oakland 3, Calif.
OAKLAND, Calif. • Portland, Ore. • Seattle, Wash. • Los Angeles, Calif. • Dallas, Texas

NEW SUTORBILT SERIES 3200 BLOWERS DELIVER HIGHER VOLUMES IN HEAVY DUTY SERVICE

The toughest high volume air and gas handling jobs are easily handled by new Series "3200" Sutorbilt lobe-type rotary positive blowers and gas pumps. One-piece shafts, precision machined helical timing gears and the special Sutorbilt timing hub are just some of the features carefully engineered into these new units for continuous, heavy-duty service and low maintenance operation.

Rated from 800 to 20,000 cfm at pressures from 2 to 10 psi, this new line is available with timing gear diameters from 10″ to 22″. Standard equipment includes machined sub-bases, a reversible oil pump with an oversized sump that eliminates an oil cooler at ambient temperatures up to 125°F and lip-type oil seals (mechanical seals in gas and vacuum pumps) that effectively prevent leakage or gas contamination.

Write today for your free copy of illustrated bulletin giving complete specifications, Department H.

Representatives in principal cities. Consult your classified telephone directory.

2192
S25

SUTORBILT IS WELL BUILT

CORPORATION, 2966 EAST VICTORIA ST. • COMPTON, CALIF.
SUBSIDIARY OF FULLER COMPANY • CATASAUQUA, PA.

FULLER COMPANY GENERAL SUTORBILT TRADE MARK

Equipment News

CONTINUED FROM PAGE 17A

the manufacturer to be within ±½ percent.

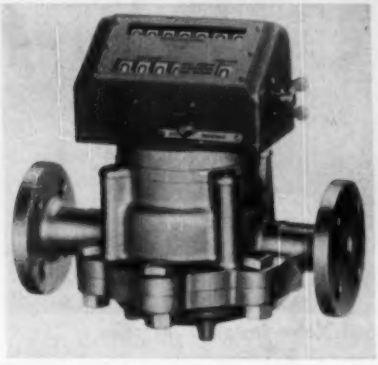
Featuring link and lever calibration and a minimum of moving parts, the unit is easy to adjust and maintain. Its large 6⅛-inch scale and fluorescent pointer make for high-visibility local indication.

All instrument components are enclosed in a weatherproof steel case which has a corrosion-resistant vinyl coating, gasketed door. Overall case dimensions: 9¼ by 11⅜ by 5 inches. A universal bracket is supplied for surface or 2-inch pipe mounting.

Chemical Liquid Meter

704

Buffalo Meter Co., Inc., Buffalo, N. Y., has added a new Chemical Liquid Meter, the BNV model, especially designed for small flows to its line of Niagara Liquid Meters.



The new meter is ¾ inch size and supplements the 1-inch and 2-inch sizes previously manufactured.

Internal works of the new unit will be constructed of type 316 stainless steel. The measuring piston, however, can be of any of a variety of materials as required. The outer casing will be constructed of stainless steel, carbon steel, or cast iron.

Available with either threaded or flanged connections, and with a full range of register types, this new meter will measure a wide variety of chemical liquids including most acids, alkaline solutions, deionized water, and edible oils.

Time And Code Automatically Printed On Recorders

705

Royson Engineering Co., Hatboro, Pa., has announced the manufacture and distribution of an easy-to-install, kit-form printing device called the Indentichart RI-5 that automatically prints date, time (to the nearest minute) and a remotely selected code number or letter on strip charts, for quick, accurate identification and interpretation of time or sequence in which conditions occur, without the need for someone to watch charts and make identifications marks.

The unit does not interfere with or obscure the recording procedure. The time clock operates continuously on a 60 cycle line and the printing mechanism is provided for operation on any AC of DC voltage from 24-115. A single printing solenoid causes simultaneous printing of time and code. Up to 12 code numbers are available, selected by remote selector switch, stepping relay or other combination of contacts.

Additional manually set code wheels can be added. The Identichart is

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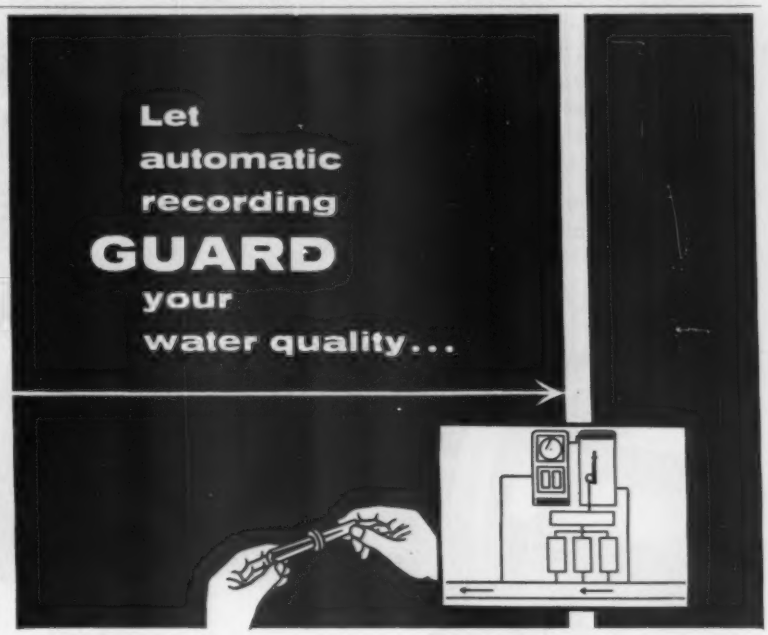


W&T RESIDUAL CHLORINATION SYSTEMS

Automatic residual recording by Wallace & Tiernan gives you a finger on the pulse of your chlorination operation. Your system's performance is analyzed; the results recorded accurately. You have an eye on water quality.

Accurate minute-to-minute records guide plant operation . . . furnish proof of your water's safety. You can analyze your operation and work out efficient maintenance and supervisory routines.

And a W&T Automatic Residual System opens the door to complete automation. You have the basis for Compound-loop Control, the ultimate in chlorination automation.

You can build Compound-loop Control component by component. As the future demands, you can add W&T auxiliary equipment to achieve this closed-loop, information-feedback system, no matter what your present arrangement.

For more information, write Dept. S-140.94

WALLACE & TIERNAN INCORPORATED
25 MAIN STREET, BELLEVILLE 9, NEW JERSEY

add control valves replace old valves FAST

with new MUELLER® Cut-In Sleeves & Valves

■ New control valves can be added to your system and old, inoperative valves can be replaced quickly with Mueller Cut-In Sleeves and Valves.

Installation is fast and simple. New Mueller Mechanical Joints on both sleeve and valve are large enough to fit class "D" pit-cast pipe and small enough to be used with class "150" centrifugally cast pipe.

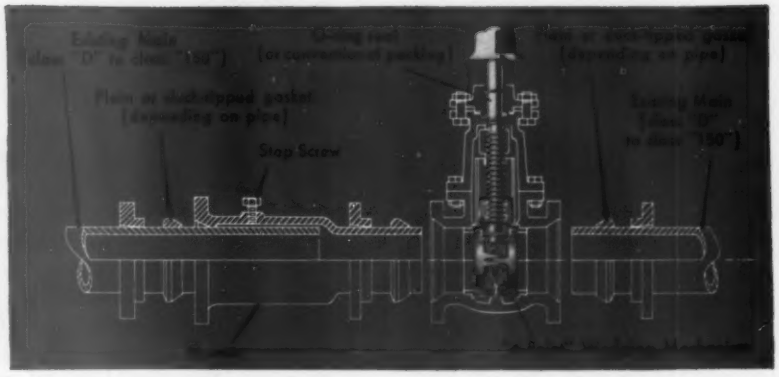
Only two gaskets are used. A solid rubber gasket is used with all larger classes of pipe, such as class "D". A special rubber gasket, reinforced on both ends with duck to prevent cold flow, is used with all smaller classes of pipe.

These two gaskets, each accurately sized to the class of pipe, make installations faster, simpler and cheaper. Joints are permanently tight, too.

Write for full information.

MUELLER Cut-In Sleeve and Valve installed in main

Standardize on* MUELLER *valves with exclusive "4-Point" wedging mechanism.



The wedging mechanism of Mueller Cut-In Valves is identical to that of Mueller AWWA Gate Valves and Tapping Valves. Parts are interchangeable. Standardize on Mueller.

MUELLER CO.
DECATUR, ILL.

Factories at: Decatur, Chattanooga, Los Angeles
In Canada: Mueller, Limited; Sarnia, Ontario

Equipment News

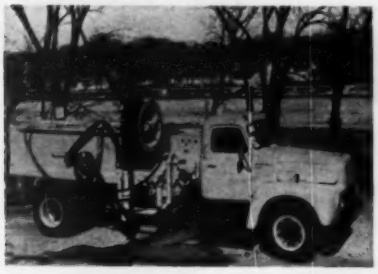
CONTINUED FROM PAGE 19A

available for all popular makes of Strip Chart Recorders and the kit includes rubber for the chart platen, mounting screws, plexiglas window to replace the original one in the recorder door, plastic transparent cover for the device itself and instructions for installation.

Demonstration Tour—Underground Sludge Cleaner

706

Elgin Sweeper Company, Elgin, Ill., has announced the inception of a nationwide demonstration tour of its latest model of the Elgin Utility Eductor, catch basin and underground sludge cleaner. This unit will make its appearance in several of the nation's larger cities as well as many of the smaller cities.



The Eductor is designed to clean underground at a ratio of 20 to 50 times faster than conventional hand-and-bucket methods. It can also double as a street flusher and as an auxiliary fire-fighting unit.

Those who may wish to know the location of the Eductor demonstration or who would like one demonstrated in their own location may write to The Elgin Corporation, 222 West Adams Street, Chicago 6, Illinois.

Supervisory Control And Telemetering System

707

Industrial Process Engineers, Newark, N. J., has developed a new binary digital high security, high speed, and high point capacity supervisory control and telemetering system that is applicable to telegraph, teletype, voice grade telephone, radio,

CONTINUED ON PAGE 23A

Back in the era of bustles and high-button shoes, certain classes of 'joints" were viewed by some as objects of scorn or derision. They even took steps to eliminate this condition of the times through the customary process of law.

Now, decades later, a completely new type of "joint" has appeared on the scene . . . no swinging doors on this one, either. It's KAUL Presto-SEAL, the ***vitrified clay pipe that joints like magic.*** And—it's gaining in popularity and certified approval by public works departments, engineers and contractors everywhere . . . by men who recognize the importance of fast pipe assembly, tight, permanent joints, assured resistance to root penetration and absolute shear load resistance. KAUL Presto-SEAL pipe features a new factory-molded-polyester compression joint with a high-quality rubber gasket permanently imbedded in the socket **where it belongs.** This revolutionary development has made Presto-SEAL a standard of quality on installations with rigid infiltration-exfiltration requirements. It's your absolute assurance of leak-proof, root-proof and corrosive-resistant lines that last forever.

Manufactured to A.S.T.M. Specifications, Presto-SEAL is available in a complete range of pipe sizes from 4" to 36" diameter, with matching fittings. ***That's right, one joint for all sizes of pipe!***

So, don't wait for an Act of Congress to make known your wants, like the folks of yesteryear did. Write today for facts that prove Presto-SEAL pipe by KAUL is best by test for all industrial waste and domestic sewer jobs.

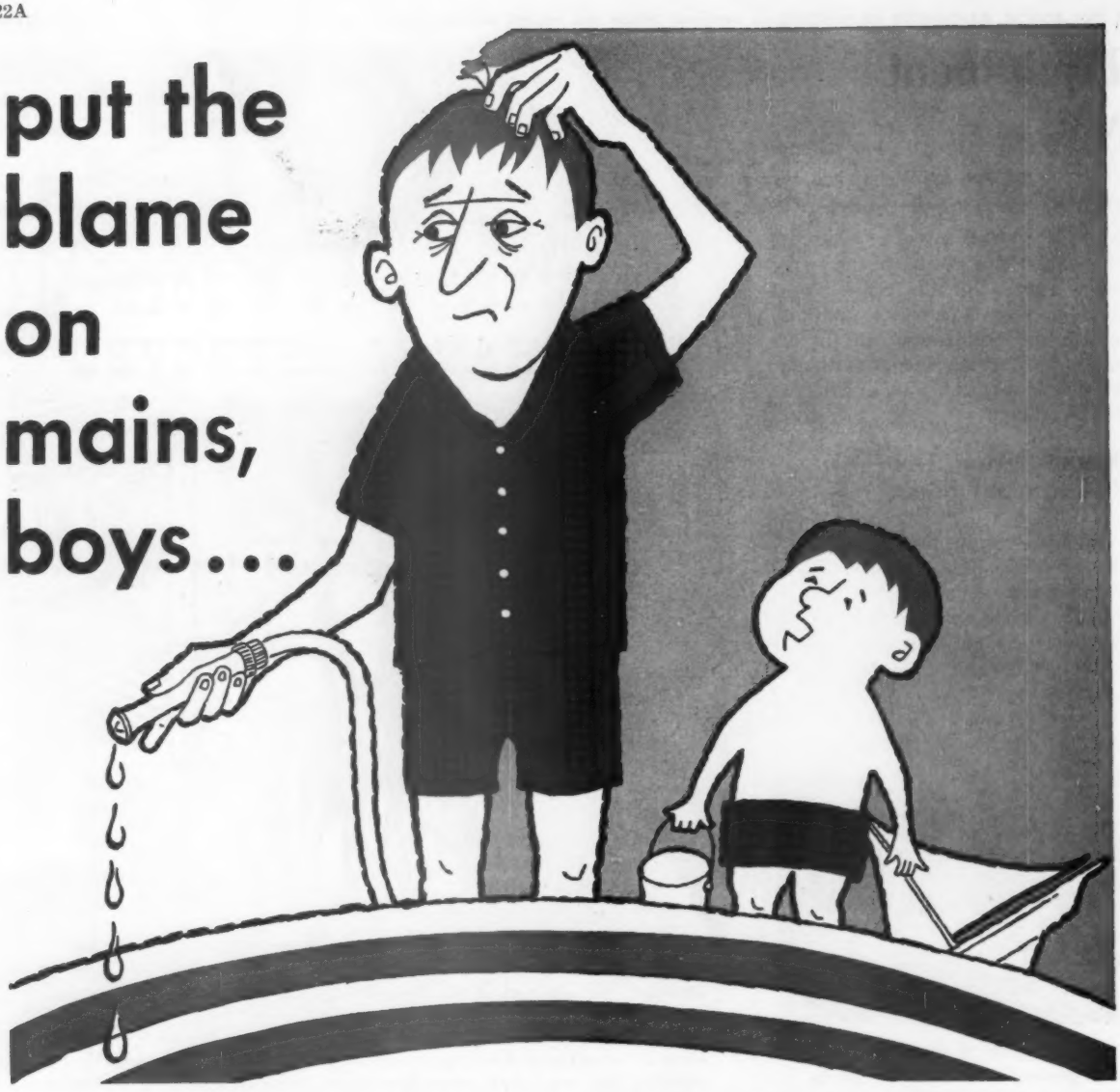
*T.M. Reg.

KAUL clay company

TORONTO, OHIO • U. S. A.

"Exclusive manufacturer of Presto-SEAL pipe that joints like magic"

put the blame on mains, boys...



Are you hearing customer complaints about low water pressure? After the spring's heavy rains which filled reservoirs to the brim all over the country, *there should be no water shortage*. The problem probably rests underground . . . mains and distribution grids choked by pressure-killing tuberculation and corrosion.

There's one sure cure for your pressure problem . . . the Centriline Process. Centrilining permanently increases carrying capacities in all sizes of pipe by eliminating tuberculation and corrosion forever. After loose scale and tubercules are removed from the pipe, the Centriline machine applies a smooth, uniform coating of cement-mortar to the pipe wall by centrifugal force. Fast and economical, Centrilining is accomplished with a minimum of interruption to surface traffic, since the pipes are lined in place and excavations are not required at laterals and services.

With the introduction of the new, small diameter Centriline machine, you can permanently protect all water lines from 4 to 144 inches in diameter. Send today for our new brochure which fully describes the Centriline Process.

CENTRILINE CORPORATION

A Subsidiary of Raymond International Inc.

140 Cedar Street
New York 6, N. Y.
WOrth 2-1429

Branch Offices in Principal Cities of the United States, Canada and Latin America.

Equipment News

CONTINUED FROM PAGE 21A

microwave, private wire, and power-line carrier communications links.

Capacities up to 2,048 discrete points are available in the standard construction of the system. Transmission speed is adjustable from the low bit-rate capabilities of telegraph links up to bit-rates of lmc, well beyond the maximum information rates of commercial channel-deriving equipment. System error-monitoring features are included which guarantee complete computer level protection against spurious control or indications intelligence.

This supervisory control and telemetering system features complete electronic solid-state encoding, transmission keying, transmission receiving, and decoding supervisory control function. Its construction is fully modular and employs plug-in printed circuits, and its power supply for the master station and slave station ends of the system can be derived from station battery supplies and/or 115v, a.c. 60-cycle single-phase supply.

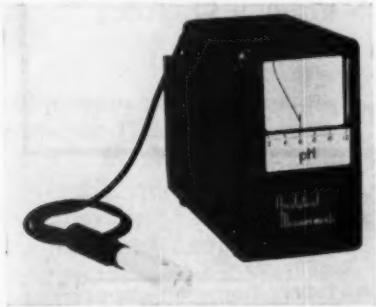
The I.P.E. system lends itself to party-line or radial-system applications where more than one slave point is involved. Multiple master-stations are permissible in either of these two basic arrangements.

The telemetering options of the new system include on-demand selective, parallel continuous, and automatic scan schemes in either analog or digital telemetering methods.

pH Meter Provides Continous Permanent Record

708

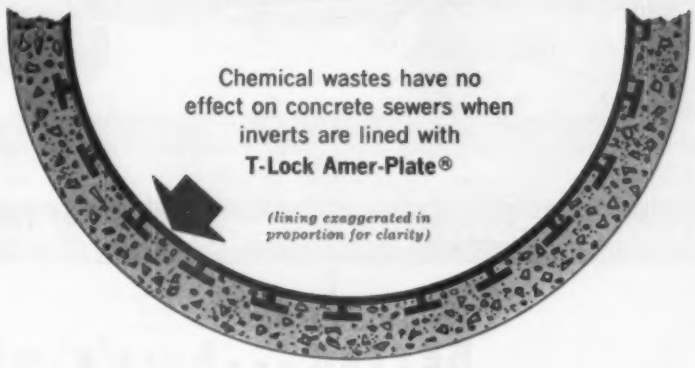
Analytical Measurements, Inc., Chatham, N. J., has introduced a recording pH meter that provides a continuous permanent record of pH changes. This instrument utilizes an electronically modulated amplifier that compensates for line voltage fluctuations and uses standard radio tubes. A strip chart recorder forms the front panel of the instrument and contains a 63 foot roll of chart paper that will last for 31 days at 1 inch per hour. Other chart speeds are available up to 16 inches per hour by a simple gear change. A pressure sensitive coating is used on the chart paper so that annoying ink and clogged pen problems are eliminated.



Connections for insertion of a platinum resistance thermometer provide automatic temperature compensation. A switch on the front panel permits disconnection of the chart drive so that the instrument becomes an indication pH meter. The pH Probe Unit provides a unitary glass electrode system completely protected by polyethylene which is designed to make possible pH monitoring that heretofore has been impractical because of complicated installation or excessive instrument costs.

CONTINUED ON PAGE 25A

How to Protect Concrete Sewers from Chemical Wastes


Chemical wastes have no effect on concrete sewers when inverts are lined with T-Lock Amer-Plate®
(lining exaggerated in proportion for clarity)

T-Lock Amer-Plate is a high polymer PVC sheet, easily cast into pipes, tunnels and structures to form a partial or complete 360° protective lining. Used in inverts, it permanently protects concrete from corrosive chemical effluents. In arch areas, it positively stops oxidized H_2S corrosion. T-Lock is also highly abrasion resistant; impartial tests show that it abrades at only 1/70th the rate of concrete.

The fact that T-Lock ends erosion and corrosion problems in industrial and municipal sewer systems is attested to by more than five million square feet now in use. Write for complete data on this maintenance-saving lining before designing your next sewer.

Applicators strategically located throughout U. S. and Canada

Amercoat® CORPORATION

Dept. WG • 4809 Firestone Boulevard • South Gate, California

921 Pitner Ave. Evanston, Ill. | 360 Carnegie Ave. Kenilworth, N. J. | 2404 Dennis St. Jacksonville, Fla. | 6530 Supply Row Houston, Tex. | 111 Colgate Buffalo, N. Y.

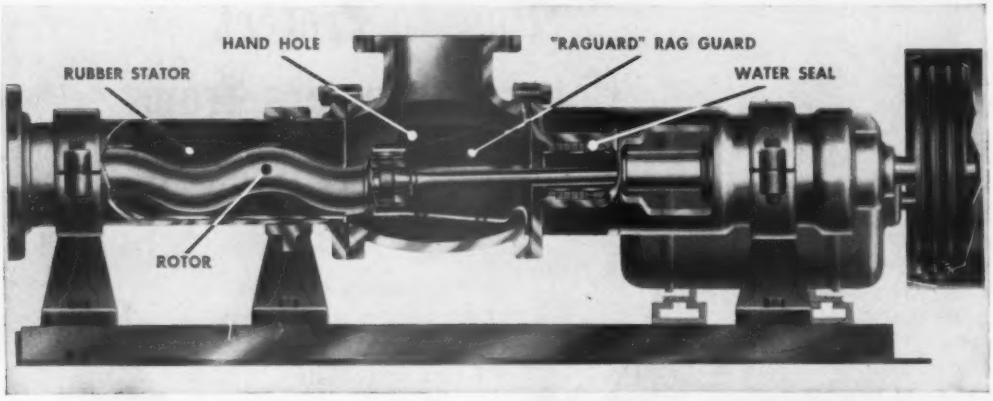
"from Chicago"

A development of 25 years of sludge pumping experience...

THE NEW

SCRU-FLO

Trade-Mark



Screw Conveyor Clog Proof Sludge Pump

BETTER...here's why:

For:

- Primary sludge pumping
- Secondary sludge transfer
- Digester sludge recirculation
- Elutriated and concentrated sludge pumping
- Digester heat exchanger pumping

Sizes: For pumping sludges from 75 G.P.M. to 400 G.P.M. . . . at a 120' head

- Rotary, positive displacement pumping
- "RAGUARD"—"Chicago's" special shaft rag guard
- Low Speed operation
- Convenient Suction Clean-out openings
- Durometer 60 hardness BUNA-N RUBBER STATOR
- Hardened, Chrome-Steel Rotor
- Ample Reserve Motor Horsepower

Putting Ideas to Work

fmc FOOD MACHINERY AND CHEMICAL CORPORATION

FOOD MACHINERY AND CHEMICAL CORPORATION
HYDRODYNAMICS DIVISION

CHICAGO PUMP

622H DIVERSEY PARKWAY • CHICAGO 14, ILLINOIS

1909 51 YEARS 1960 CHICAGO PUMP COMPANY

© 1960 F. M. C.

Equipment News

CONTINUED FROM PAGE 23A

New Method for Connecting Plain End Pipe

709

Victaulic Company of America, Elizabeth, N. J., has developed and engineered the Plainlock Method of Piping to afford a simple, low cost and leak-tight method of connecting plain end pipe with positive-grip couplings and "Full-Flow" fittings.

This method consists of Plainlock couplings and fittings for use with plain or beveled end pipe. These couplings are designed with two bolts for fast, easy installation and are fitted with hardened stainless steel grips that engage the pipe ends and securely lock them together. An ordinary wrench with normal torque is sufficient to seat the grips in the pipe or fitting ends. Use of Victaulic "Triple-Seal" gaskets, molded of resilient compounds, is designed to provide leak-tightness and long life under rigorous service conditions. The couplings are built for tough service. Bolts and nuts are plated for maximum corrosion resistance.

No pipe end preparation of any kind is required as ordinary plain or beveled end pipe may be used "as is". The pipe need only be cut to length desired, and it is ready to be joined with Plainlock. Maximum gripping power is obtained with standard weight (Schedule 40) steel pipe. The method is also suited for joining pipe of other materials and pipe of lighter than standard wall thicknesses, at lower operating pressures.

Plainlock couplings and fittings are available in sizes 1″, 2″, 2½″, 3″, 4″and 6″.

Chlorinator Has Corrosion Resistant Construction

710

Fischer & Porter Co., Warminster, Pa., announces development of its new Series 3400 line of chlorinators, featuring the exclusive Stack Regulator. This simplified design concept, used in previous models, has now been extended to the entire chlorine control section, permitting significant advances in accuracy, safety and flexibility. One basic model of the new line provides manual or automatic control over capacity ranges from 0.1 to 2000 pounds per day.

For complete protection against corrosion, the new units are housed in rigid, single-unit fiberglass cabinets. The two-tone beige color is an integral part of the cabinet, completely eliminating painting or other maintenance. All piping and working parts are also made of plastics or corrosion resistant alloys, insuring immunity to chlorine attack.

Controlomatic models of the new line accept electric, pneumatic, or vacuum signals from any type of metering device, and accurately feed chlorine according to proportional, start-stop, program, multiple rate, or residual control requirements. A Vis-I-Flow valve permits visual observation of the rate valve.

Horsepower

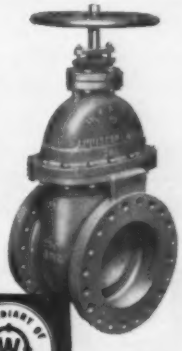
Substitution of mechanical horsepower for human muscle-power, is largely responsible for the amazing expansion of the U. S. economy until it leads the world with the highest standard of living. Economists call it the American industrial revolution.

M & H is truly a product of the American industrial revolution. The Company's real growth and development started in 1932, when M & H was reorganized and joined the mechanical horsepower movement. About that time the electric motor was being introduced as a source of industrial power. Realizing this trend, M & H Management redesigned its products and modernized its production equipment.

Slow, tedious, hand-operated manufacturing processes were discarded. Sand equipment, cranes, machine tools, every M & H wheel was soon being turned by electric power.

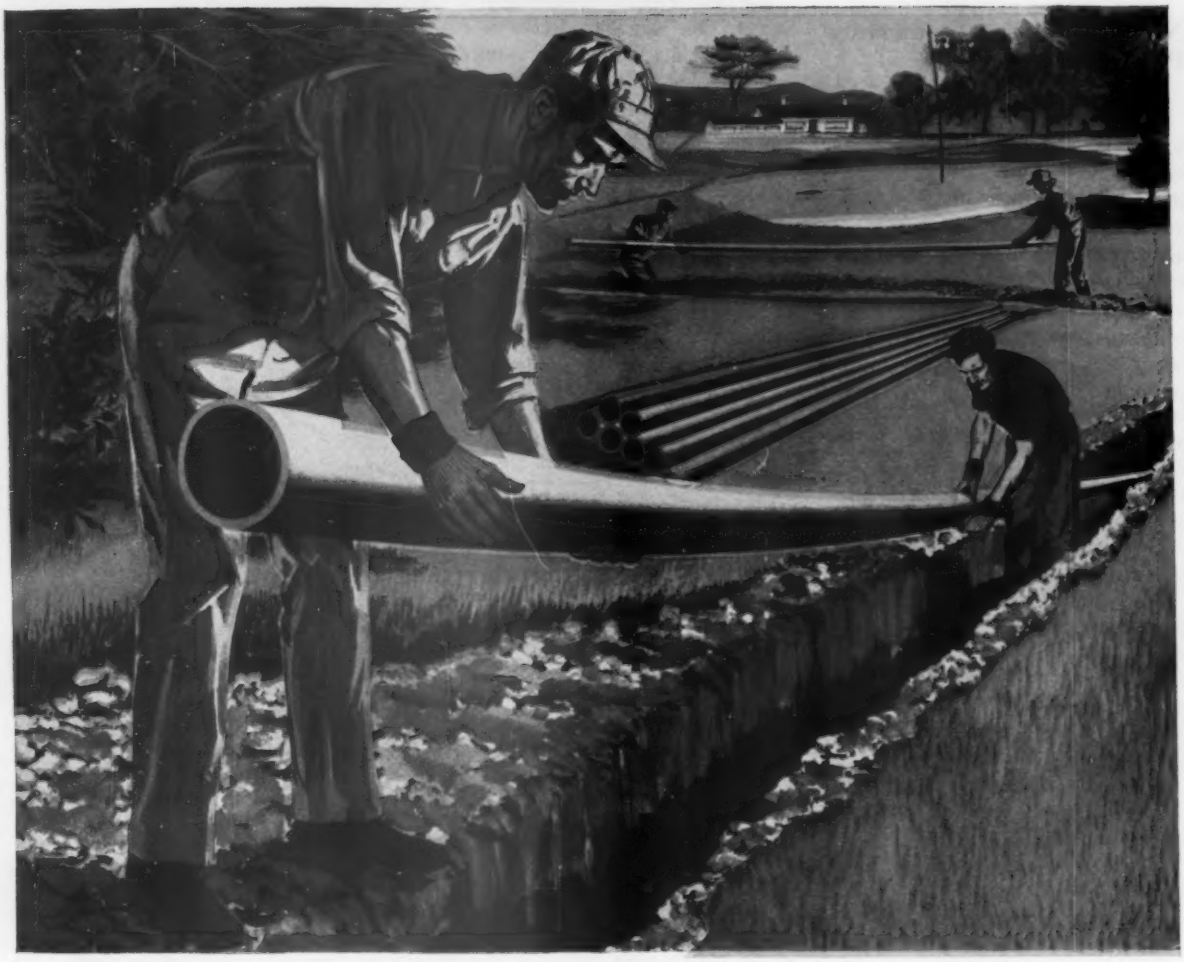
Rapidly the Company's volume of sales and production began to grow. With the years, it gathered momentum because the M & H plant modernization kept up with new developments and never stopped. The Company's annual sales volume now makes it one of the most successful valve and hydrant producers in the country—thoroughly equipped to provide highest quality products for water works improvements.

(No. 2 of a Series)



M&H VALVE AND FITTINGS COMPANY
ANNISTON, ALABAMA
SUBSIDIARY OF W WALWORTH

Naugatuck KRALASTIC®
SPRINKLER SYSTEMS



4 men installed a mile of pipe per week!

In fact, it was more than a mile per week on this big golf course in the Middle West. KRALASTIC ABS plastic pipe was selected for the sprinkler system originally because of its freedom from corrosion and rust. Consider, too, the impressive saving in installation time. (Previous sprinkler jobs required a crew of 11 men over 3 weeks.) This type of performance, savings in labor, ease of installation, low cost, durability, comprise the story behind the constantly widening use of KRALASTIC pipe in hundreds of different applications. Over 10,000 miles of KRALASTIC pipe have been installed in the last few years.

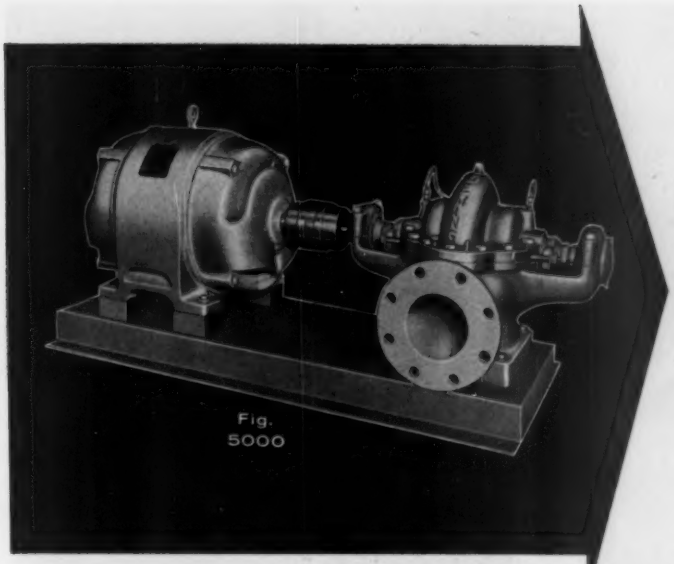
KRALASTIC is the tough, original ABS rubber-resin material that has long since proved itself in water transmission lines, electrical conduit, natural gas, radiant heating and hundreds of other tough applications. Learn more about KRALASTIC; write to address below.

US RUBBER

United States Rubber
Naugatuck Chemical Division
DEPT. 754K, ELM STREET
NAUGATUCK, CONNECTICUT

KRALASTIC RUBBER-RESINS • **MARVINOL** VINYLS • **VIBRIN** POLYESTERS

Akron · Boston · Chicago · Gastonia · Los Angeles · Memphis · New York · Phila. · CANADA: Naugatuck Chemicals · Elmira, Ont. · Cable: Rubexport, N.Y.



SPLIT-CASE CENTRIFUGAL

Provide peak performance for heavy, continuous pumping of clear water. The Deming Split-Case Centrifugal is a rugged unit with all rotary elements in perfect balance, both statically and dynamically, assuring vibrationless operation. A full range of sizes from 2" to 14".

DEMING PUMPS

FOR EFFICIENT WATER WORKS SERVICE

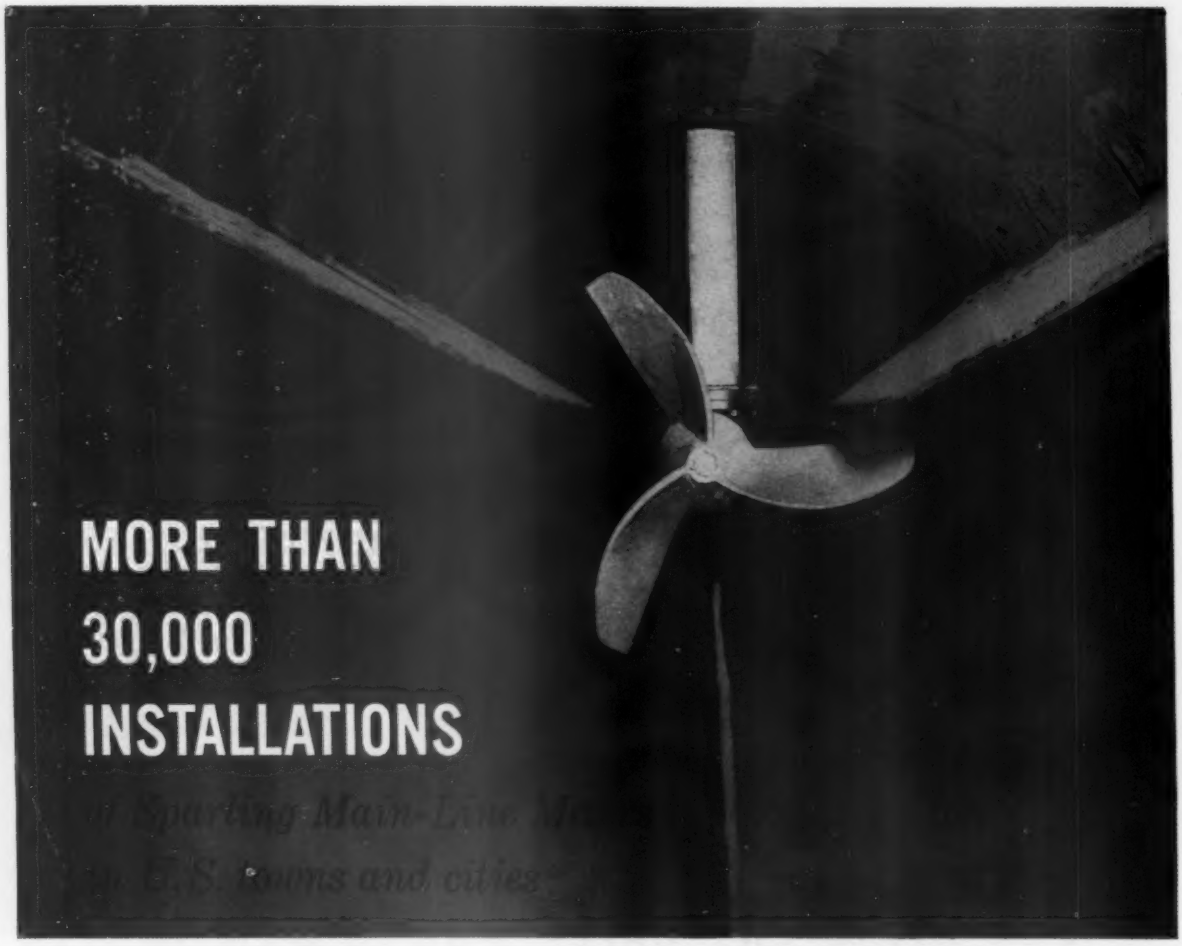
VERTICAL TURBINE

Dependable, economical. Designed and manufactured to meet discriminating Water Works installation standards. Deming Vertical Turbines are available with any type of power in a wide range of capacities to meet your specific requirements.

Ask for a recommendation on your next project

The DEMING Co.

788 BROADWAY • SALEM, OHIO

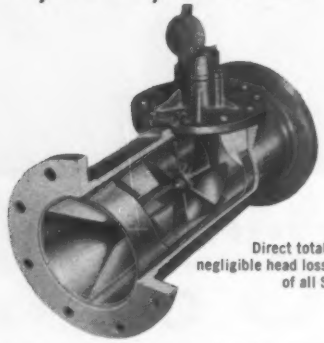


providing totalization of varied flows from

30 GPM

to

1,500,000 GPM



Direct totalization and accuracy with negligible head loss are outstanding features of all Sparling Main-line meters.

More than 30,000 Sparling Main-line meter installations are serving American towns and cities every day, with thousands more in use throughout 29 foreign countries. Applications vary from single 2-inch meters for minimal requirements to multiple 19-foot installations that handle flows in excess of 1½ million gallons per minute... universal proof that wherever, or whatever, the need for Main-line metering you can specify, and depend on, Sparling.

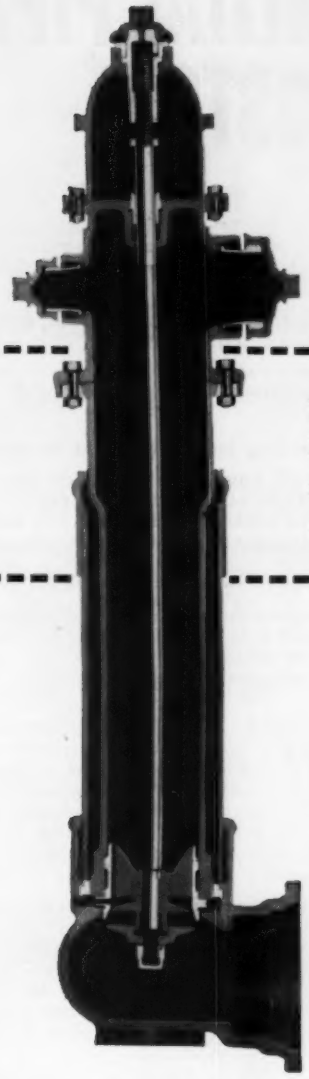
Sparling is the pioneer propeller meter. For nearly half a century Sparling equipment has been serving the waterworks field with high performance meters, recording instruments, and controls. Let Sparling serve you, too. *Write for Catalog #315, or call your local Sparling field engineer.*

SPARLING
WATER CONTROL EQUIPMENT

HERSEY-SPARLING
METER COMPANY
Sparling Equipment: **EL MONTE, CALIF.**
225 North Temple City Blvd.

Branches: Atlanta · Chicago · Cleveland · Dallas · Denver · Kansas City, Mo. · Roselle, N. J. · San Francisco · Seattle • United Kingdom Affiliate: TYLORS OF LONDON LTD.

ONLY MATHEWS HAS ALL THE DESIRABLE FEATURES



What do you look for in a hydrant? Dependability... replaceable barrel?... conventional packing?..."O" ring seal?...stop nut to prevent stem from buckling? We could double this list and still not cover all the features we build into Mathews Hydrants *by design.* Mathews has them all.

DEPENDABILITY

Mathews Hydrants are always ready for service, because their design is fundamentally sound and simple. In 90 years we have never changed the basic design—only refined it, by detail.

AND ALL THESE OTHER FEATURES, TOO: All working parts contained in replaceable barrel • Head can be faced in any direction • Replaceable head • Any nozzles you specify • Nozzle levels raised or lowered without excavating • Leakproof because stuffing box is cast integral with nozzle section • Operating thread only part requiring lubrication • Protection case of "Sand-Spun" cast iron for strength, toughness, elasticity • With bell, mechanical joint or flange pipe connections

Conform to latest AWWA specifications

R. D. WOOD COMPANY

Public Ledger Building, Independence Square, Philadelphia 5, Pa.

Manufacturers also of Mathews Flange Barrel Hydrants, R. D. Wood Hydrants, R. D. Wood Gate Valves, and "Sand-Spun" Pipe (centrifugally cast in sand molds)

DON'T BE FOOLED BY INITIAL PIPE COSTS...

Certain factors concerning the type of pipe to be used for a proposed water or gas project must be examined carefully:

First
—how much does the pipe cost, compared to other types?

Second
—how often will it require repair?

Third
—how long before it has to be replaced?

After all, how much money do you really save if you buy the cheapest pipe . . . then have to repair it frequently . . . and *then* have to replace it within a decade or two?

You save with cast iron pipe

Sometimes the first cost of jobs where cast iron pipe is specified, is higher than similar projects using cheaper pipe. Yet, in the long run, cast iron pipe costs *less!* Here's why:

- Cast iron pipe rarely requires repairs. Its rugged construction, corrosion-resistant qualities and bottle-tight rubber-ring joints will withstand the most severe pressures. Once an investment is made in cast iron pipe, it is usually your first and last cost because of the absence of maintenance or repairs.

- Cast iron pipe is built to *last*—98 American cities will testify to that. They've had cast iron pipe installations in constant use for over a century! In fact, in Versailles, France, they're still using cast iron pipe water mains that were laid in 1664! Once cast iron pipe is in the ground, it stays there!

Don't be fooled by "low-cost" pipe. Insist on the pipe that will actually save you money over a period of years . . .

In Nebraska—Here a section of cast iron pipe is being relocated. Twenty-five years old, the pipe is still in excellent condition—has never required major repair . . . or replacement.

Rely on CAST IRON PIPE

In Indiana (above)—"All-weather" cast iron pipe is quickly installed despite wet trench conditions. Slip-on joints were easily assembled, with one workman using a crowbar.

In Kansas (above)—36" cast iron water main. Another part of this main was floated out of its trench by a heavy downpour. Later a 150 psi water test revealed no leaks in the slip-on joints!

In Pennsylvania (below)—This 16" cast iron pipe is being installed as fast as the trench hoe can prepare the trench.

Handy lengths and slip-on joints make cast iron pipe easy to handle, even in crowded neighborhood sectors; require less labor.

CAST IRON PIPE

THE MARK OF THE 100-YEAR PIPE

Cast Iron Pipe Research Association,
Thos. F. Wolfe, Managing Director, 3440 Prudential Plaza, Chicago 1, Illinois

"'K&M' ASBESTOS-CEMENT

LAYS AS FAST AS

Assembling 16" "K&M" Asbestos-Cement Pressure Pipe by hand without the aid of a bar. The backhoe merely steadies and aligns the pipe. The easy, two-step operation consists of (1) lubricating the tapered end of the pipe, and (2) sliding pipe into coupling.

PRESSURE PIPE

A SHOVEL DIGS..."

G&B Construction, Inc., Youngstown, Ohio, installs 4½ miles of "K&M" Asbestos-Cement Pressure Pipe for the Austintown District of Mahoning County, Ohio

"You can lay 'K&M' Pipe as fast as a shovel can dig. There is nothing that will hold you back with this pipe. When you can lay a 16" water line, and it goes in as easy as an 8" water line, what more could you ask? They've got a good joint with that FLUID-TITE® Coupling . . . the pipe is wonderful to put together. There is no comparison between the FLUID-TITE Coupling and other couplings. Of all the 'K&M' Pipe we've laid, we never had a coupling break. Coupling breaks are very common with other pipe."

Those are the comments of Louis Gulfo, partner with Mike and James Bertilacci in G&B Construction, Inc. They installed "K&M" Asbestos-Cement Pressure Pipe in bitter cold, during February and March 1960. However, neither rain, snow, nor mud interrupts the installation of this modern pipe. The exclusive, patented "K&M" FLUID-TITE Coupling and the simple fitting procedures required make assembly easy.

Little or no maintenance will face Mahoning County, which built and will operate the system for a year, or the City of Youngstown, Ohio, which will then take it over. Being non-metallic, "K&M" Asbestos-Cement Pressure Pipe won't rot, corrode, or tuberculate, and is immune to electrolysis. The suppliers of this pipe were Trumbull Plumbing Supply Co., Warren and Youngstown, Ohio.

Now, in addition, you may use quality "K&M" Plastic Pressure Pipe in the same system with "K&M" Asbestos-Cement Pipe, if desired.

Write today for more information on "K&M" Asbestos-Cement Pressure Pipe to: Keasbey & Mattison Company, Ambler, Penna. Dept. P-970.

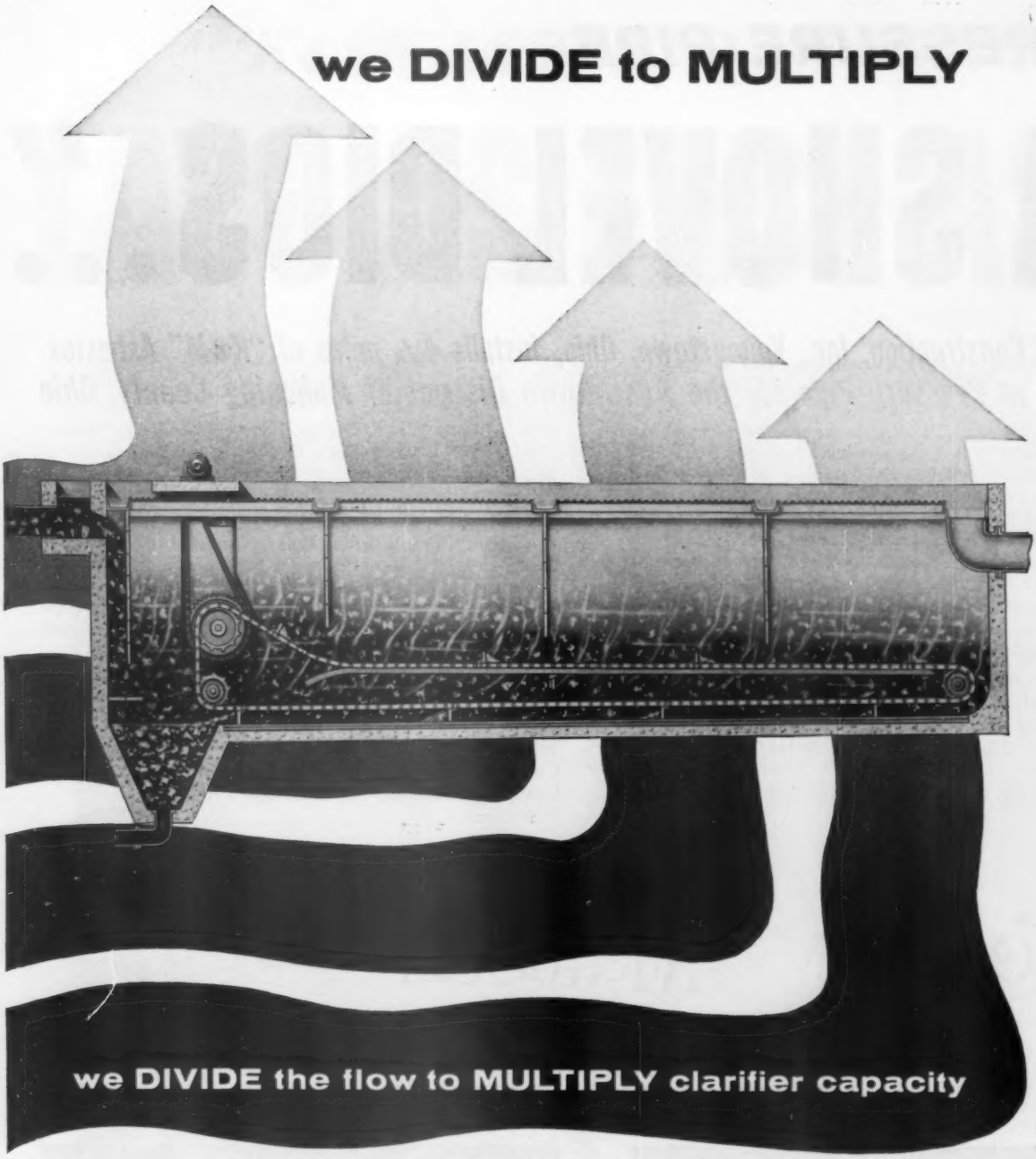
K·M BEST IN ASBESTOS

Keasbey & Mattison at Ambler

Left to right: Louis Gulfo, G&B Construction, Inc.; Dale MacCleary, sales manager, Trumbull Plumbing Supply Co.; James Bertilacci, G&B Construction, Inc., Burke Lyden, Asst. Chief Engineer, Youngstown, Water Dept., Jim Bisciglia, Asst. Engineer, Mahoning County, and J. Henry Painter, Trumbull Supply Company.

3 miles of 16" "K&M" Asbestos-Cement Pressure Pipe were installed. Here, we see it ready for installation along Webb Road, in Austintown Township. In branching from the 16" water line, Mahoning County used 1 mile of 12" "K&M" Asbestos-Cement Pressure Pipe and ½ mile of 8" "K&M" Asbestos-Cement Pressure Pipe. Specifications call for 90 lbs. pressure when line is in operation serving 16,000 residents.

we DIVIDE to MULTIPLY



we DIVIDE the flow to MULTIPLY clarifier capacity

Rex Verti-Flo not only increases the clarifying capacity of tanks up to four times; it provides a far clearer effluent. The savings in equipment and construction costs are obvious. Here's how Verti-Flo does it: The unique design of Rex Verti-Flo Clarifier transforms the conventional horizontal-flow tank into a vertical-flow tank...utilizing the *full volume* of the tank and *minimizing short-circuiting*. This is accomplished by a system of collecting troughs, weirs and partitioning baffles which divide the large, horizontal settling zone into a series of small, vertical-flow cells. To assure maximum flow length and control, the weirs are adjustable entirely around the periphery of each cell.

Installed in existing tanks, Verti-Flo can be at least double the capacity of the tank...in new installations, Verti-Flo provides up to four times more capacity so that smaller basins can be used with considerable savings in both equipment and construction costs.

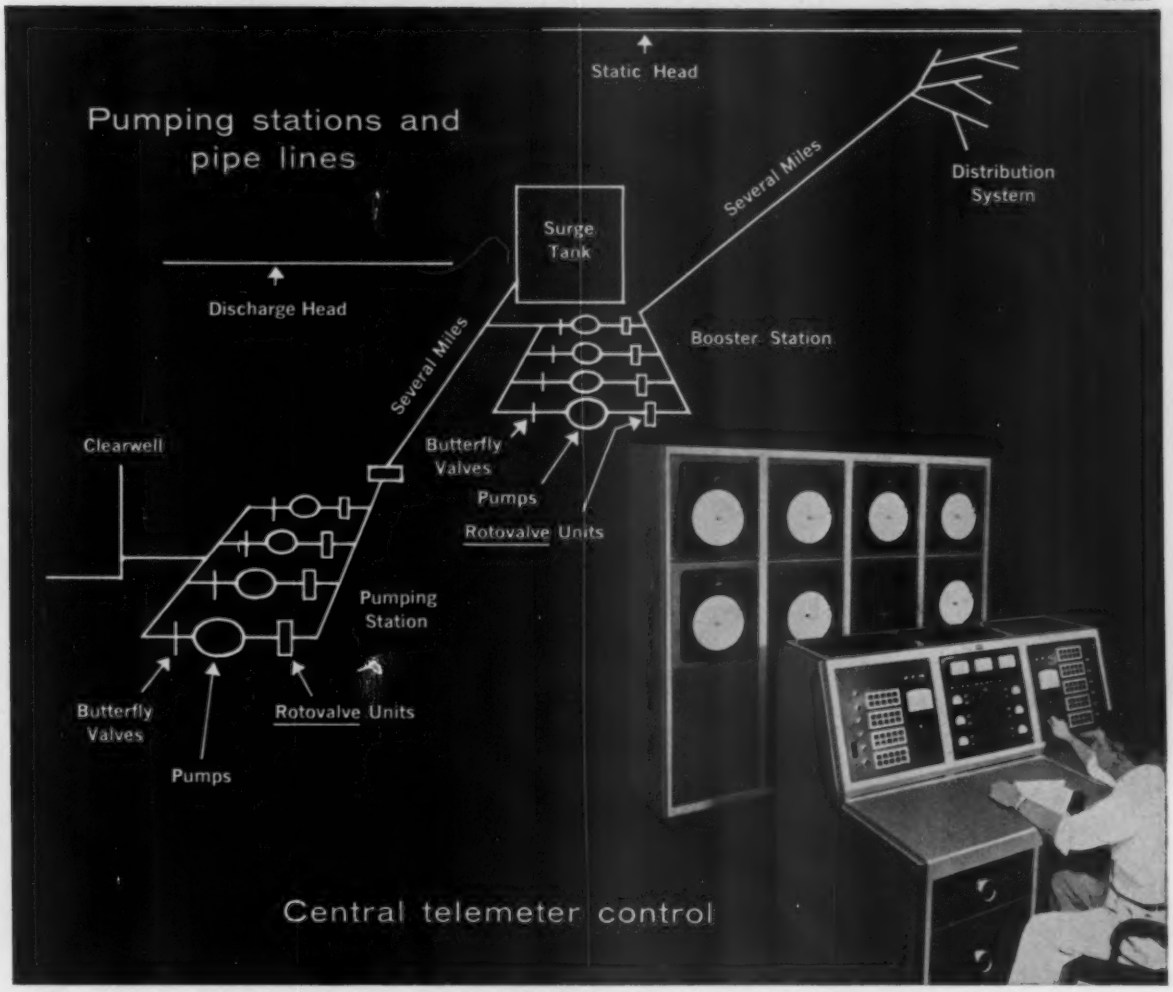
For information, write CHAIN Belt Company, 4610 W. Greenfield Ave., Milwaukee 1, Wis.

REX®

CHAIN BELT COMPANY

ALLIS-CHALMERS

A-1229



One man controls 60 mgd with

telemetered valving

Pumping stations operate completely unattended, controlled from a central remote console in this major water procurement and distribution system. Rated for 60-mgd peak load, it distributes over a 100-square-mile area from widely separated stations and storage tanks.

This is another dramatic example of complete valving service offered industry by Allis-Chalmers. Whatever you're dealing with, liquids or gases, including highest temperatures and pressures — Allis-Chalmers is your convenient source of today's most comprehensive rotary valve line. Types and sizes cover virtually every need . . . including *Rotovalve* units, butterfly and wafer valves and ball valves. We can also assist you in every phase of planning, engineering and installation. *Contact your Allis-Chalmers representative, or write* **Allis-Chalmers,** *Hydraulic Division, York, Pa.*

Rotovalve is an Allis-Chalmers trademark.

Key to a superior valving system, Rotovalve units offer the least pressure loss . . . ideal flow characteristic . . . controlled timing . . . positive seating . . . easy operation always.

take the guesswork out of taste and odor control !

rely on

AQUA NUCHAR

ACTIVATED CARBON FOR TASTE AND ODOR CONTROL

Constant conditioning to odors makes it difficult for operators to notice day to day changes in water taste and odor. That's why plants across the country depend on daily threshold odor surveys and continuous, controlled dosages of AQUA NUCHAR Activated Carbon to maintain constant PALATABILITY.

These operators have found that AQUA NUCHAR is the one method universally effective against taste-and-odor-forming substances, commonly found in water supplies. Concentrations required average as low as 2–5 ppm, so AQUA NUCHAR is economical, too.

Our field technical service staff is ready to help you set up a PALATABILITY program in your plant. Once established, you can rely on fast AQUA NUCHAR delivery from 25 strategically located warehouses. For information, phone or write us today.

industrial
CHEMICAL SALES
division west virginia pulp and paper company

230 Park Ave., New York 17 · Philadelphia National Bank Bldg., Philadelphia 7 · 35 E. Wacker Dr., Chicago 1 · 2775 S. Moreland Blvd., Cleveland 20

"Did I get burned by a low pump bid!"

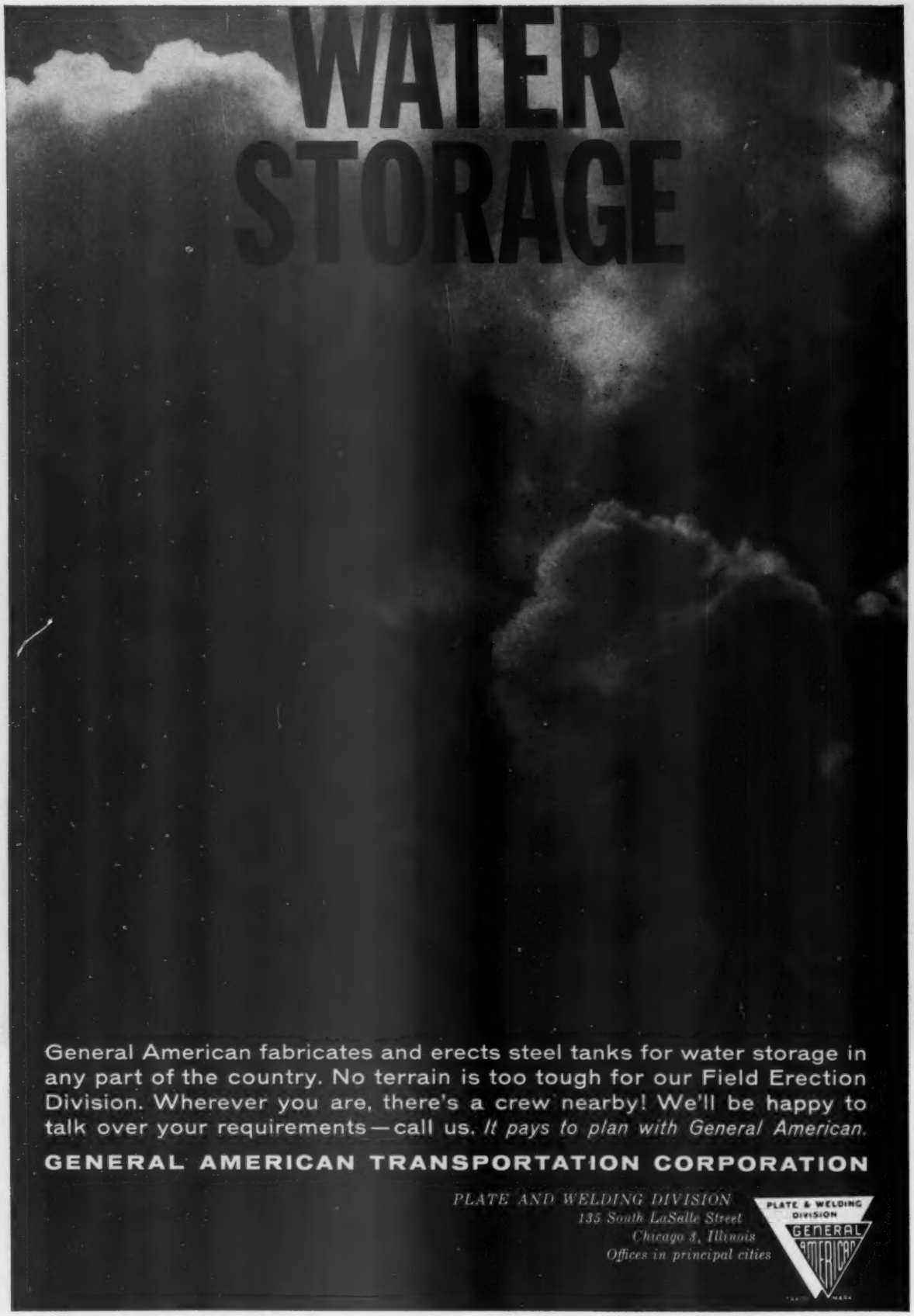
"Sure we got a low price on our pumps — 3% lower — but we're plenty sorry we didn't write an experience clause into the specs. We've had nothing but trouble and complaints since those pumps went into operation. Sure the manufacturer is cooperative. Why shouldn't he be. He's using *us* as a guinea pig on an untested design. I can't afford to be a testing department for every 'Johnny-come-lately.' I want pumps that *work*. Next time we'll have an 'experience clause.' When it comes to buying pumps . . . one burn is too many."

Reliability — one of the inherent qualities you get when you buy Allis-Chalmers. General Products Division, **Allis-Chalmers,** *Milwaukee 1, Wisconsin.*

A-1242

ALLIS-CHALMERS — 92 YEARS OF PUMP EXPERIENCE

Allis-Chalmers has a pump-building history going back over 90 years. In 1888, we developed the largest centrifugal pumps of that time . . . and they are still operating. Through a program of sound, gradual development, Allis-Chalmers pump designs are improved regularly with tested ideas . . . no idea goes into production for our customers until it has been proved sound in tests.


WATER
STORAGE
General American fabricates and erects steel tanks for water storage in any part of the country. No terrain is too tough for our Field Erection Division. Wherever you are, there's a crew nearby! We'll be happy to talk over your requirements—call us. *It pays to plan with General American.*
GENERAL AMERICAN TRANSPORTATION CORPORATION
PLATE AND WELDING DIVISION
135 South LaSalle Street
Chicago 3, Illinois
Offices in principal cities
PLATE & WELDING DIVISION
GENERAL AMERICAN

BADGER'S COMPOUND WATER METER ASSURES FULL REVENUE FOR ALL WATER DELIVERED

Wherever water flow rates fluctuate considerably during the day — in schools, factories, hotels, theaters, apartment houses, dairies, laundries — Badger's compound meter assures economical, efficient service.

This compound meter combines Badger's disc and turbine meters to provide accurate registration at all rates of flow. You get the full revenue to which your water department is entitled for water actually delivered.

It is the industry's only compound meter where only one side operates at a time. A patented balanced compounding valve directs small streams through the disc meter, large streams through the turbine side... for accurate measurement of all rates of flow, less wear and longer service life.

Write for complete details now.

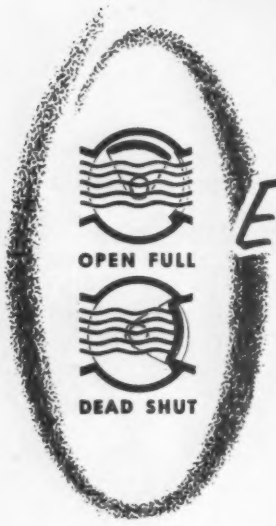
Badger Water Meters

BADGER METER MFG. CO. • 4545 W. Brown Deer Rd. • Milwaukee 1B, Wisconsin • *Offices in principal cities*

HERE'S WHY

DeZurik Valves Excel

IN WATER TREATMENT AND SEWAGE DISPOSAL PLANTS



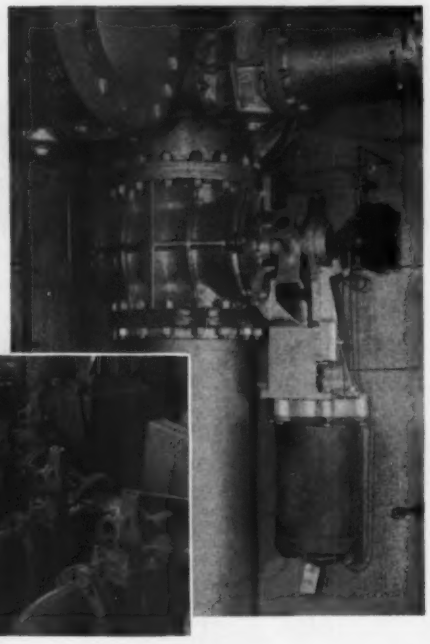
ECCENTRIC ACTION

DeZurik Valves are the ONLY valves designed on this unique principle. Their single-faced, cam-shaped plug is pivoted to match the eccentrically-raised body seat, *only* when the valve is closed. Opening the valve backs the plug away from the seat and it swings open without friction, without binding . . . without the need for lubrication! The resilient plug facing assures dead-tight shut-off every time—despite solids in the flow—again without the need for lubrication!

These distinct advantages of DeZurik Valves have made them one of the fastest growing valves in the municipal field. Consulting engineers, contractors and plant personnel—in case after case—have seen that DeZurik Valves deliver *more*, for *less* money, with *longer* life, with *less* maintenance THAN ANY OTHER VALVE!

Why not find out more about these DeZurik Valves. Whether you're planning a new plant or replacing worn out valves in your present system, DeZurik Valves can give *you* the same advantages they've brought to hundreds of other plants.

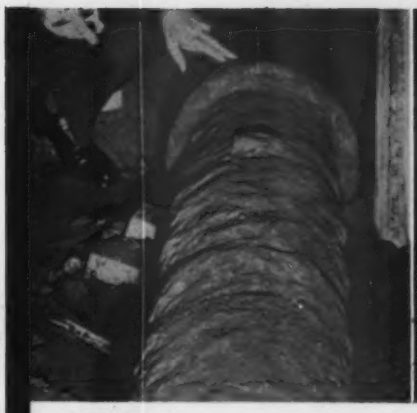
See the DeZurik representative near you or write for further details.



DeZURIK CORPORATION
SARTELL, MINNESOTA

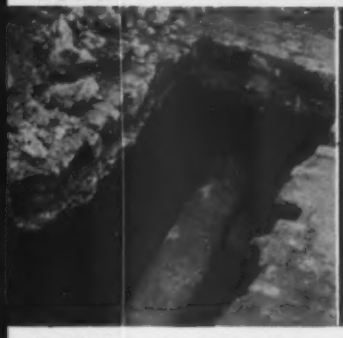
Available in sizes ½" thru 20"; manually or remotely operated; in straight-way, 3-way or 4-way models.

TIME IS THE Only 1 TEST THAT TELLS



1816 MONTREAL, CANADA
10" Water Main

1834 READING, PA.
4" Water Main



1834 BALTIMORE, MD.
10" Gas Main

1830 PHILADELPHIA, PA.
6" Water Main

1831 RICHMOND, VA.
8" Water Main

1828 LYNCHBURG, VA.
7" Water Main

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But none of these claims are backed by the *only test* that provides positive proof of the length of time that pipe will give trouble-free service in city water mains. That test is **TIME.**

Today 111 Cities Are Still Using Cast Iron Pipe That's a Century Old or More

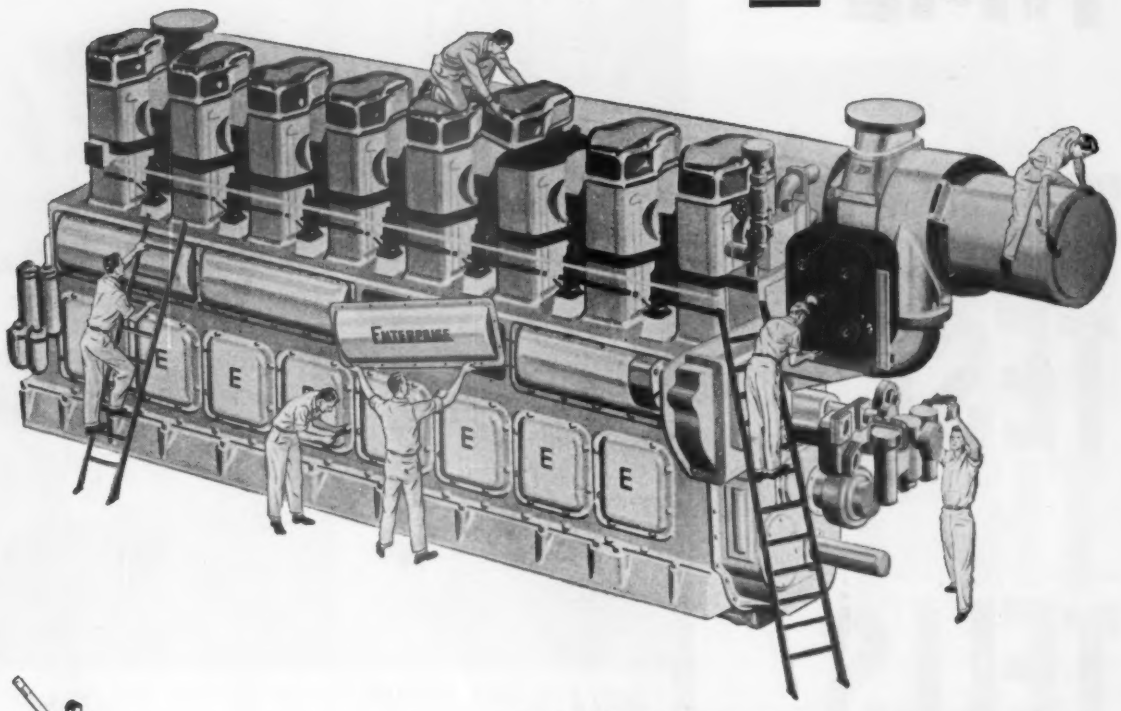
No other pipe ever made can match this record of long-lived service. Today's modernized Cast Iron Pipe is even more economical and efficient... stronger, tougher and more uniform in quality.

That's why this year, as every year, more miles of underground Cast Iron water mains are in use than all other kinds of pipe combined.

This advertisement is published in the interests of the Cast Iron Pressure Pipe Industry by.....

WOODWARD IRON COMPANY
Since 1882
WOODWARD, ALABAMA

It's easy to get to all the parts



Check these points
on "Easy-Access" ENTERPRISE Design
All major moving parts are enclosed with removable covers:
Main and connecting rod bearings are fully accessible through large door plates on both sides.
Cams, followers, camshafts and bearings are easily reached and removed.
Cylinder head and rocker arm assemblies, push rods and fuel nozzles are easy to reach by removing oil and dust-proof covers.
Gears are accessible through easily removable inspection covers.
No bulky shrouds or surplus covers to remove before getting to engine.
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You'll find that ENTERPRISE accessibility saves time, money and manpower in maintenance and overhaul

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pressure sealing "O"-rings provide positive sealing without mechanical seating device.

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Teflon-coated straight plug eliminates periodic maintenance.

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2" valves at 125 p.s.i. pressure easily operated with 12" wrench — even after prolonged idleness.

PROVEN
20 years of laboratory tests, 12 years of field tests . . . survived 45,000 openings, closings without leaking, changing "O"-rings, or greasing!

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WATER & SEWAGE WORKS

Attractive, clean, efficient, and service describes . . .

Decatur, Alabama's Water System

by W. H. GILMORE
Asst. Sanitary Eng.
Alabama State Health Dept.

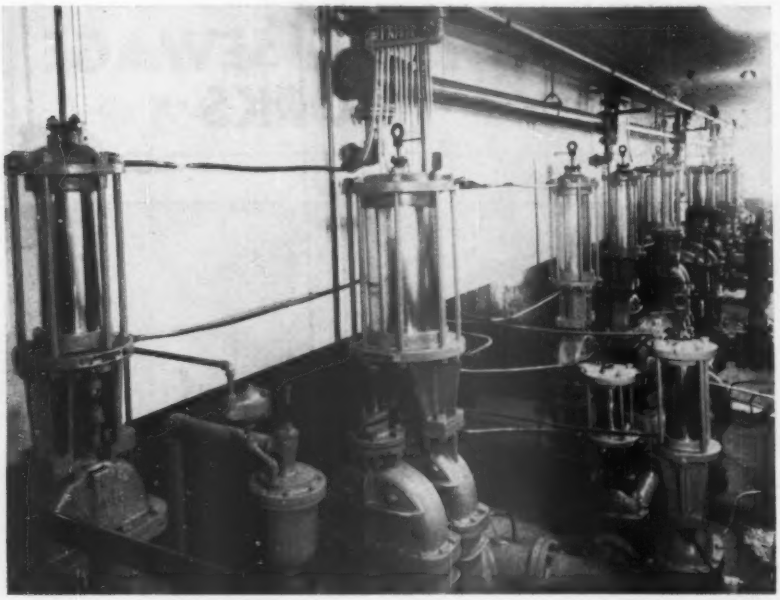
EDITOR'S NOTE: Keeping up with the continual and pressing problem of supplying adequate water for a growing community, Decatur's water system is a notable example of how this problem can be successfully met. Small wonder that its operators take such great pride in the plant, its operation and appearance.

■ AT THE ENTRANCE of the Decatur, Alabama water filtration plant, a ceramic tile mural over the door contrasts the old dug well, rope and bucket water supply with the modern Decatur water system.

In the lower left corner of the mural, the raw water pumping station is depicted. Water from the Tennessee River is pumped to the inlet box of the conventional type plant where chlorine, alum and lime are added. The artist then shows the rapid mixers and flocculators from which the coagulated water enters the settling basin. Next the mural shows the gravity filters with their sand and gravel layers. In the lower right hand corner, the clear water reservoir and service pumps are shown. Through the pipe lines, shown in blue, the water flows to homes, schools, industry, fire hydrants and the surplus to storage. The relative size and shape of Decatur's 2 M.G. elevated tank, constructed in 1949, is shown in the upper left corner.

Thus, the mural vividly portrays the development of the City's water system from its crude beginnings to its present-day efficient, modern plant that amply provides for the needs of an expanding community.

The City of Decatur, is located on the south shore of TVA's Lake Wheeler, in the heart of the beautiful Great Lakes of the South. Wheeler, Wilson, Pickwick, Guntersville and many other TVA lakes provide one



Pipe gallery: The plant's equipment include twelve, 1 M.G.D. gravity sand filters based on 2 gpm per square ft of filter sand area and 6 hours retention.

of the best vacationlands in the United States. They also provide abundant industrial water and electric power. These two resources together with adequate labor, river, rail and highway transportation and other facilities have attracted much industry. Over sixty firms have plants located in Decatur, including such nationally known names as Chemstran, Fruehauf, Goodyear, Wolverine Tube, Worthington, Carnation, Pet, and Alabama Flour Mills.

The Municipal Utilities Board of the City of Decatur owns and operates the water, gas and electric systems and operates the sewerage facilities serving this fast growing City of 32,000 people and its environs. George H. Godwin is Manager of both the Water and the Sewage Departments.

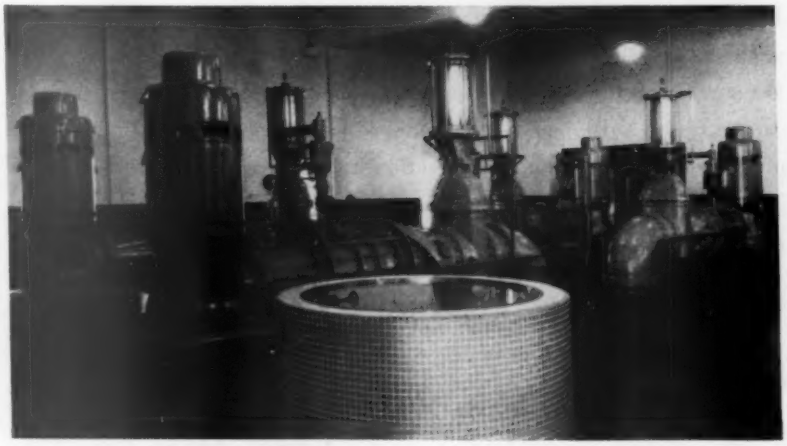
The original water filtration plant was constructed in 1889. Raw water was obtained from the Tennessee River. The facilities consisted of a circular brick pump pit, 54 feet in diameter, in which cross compound steam pumps were located. A boiler house was located near the pit. Water was pumped to two round cypress settling tanks, 30 feet in diameter. Settled water passed to four cypress tank gravity filters having a capacity of .5 M.G.D. The filtered water was pumped to the distribution system from the small clear water reservoir located under the filters.

In 1922, a concrete settling basin, with four M.G.D. capacity (based on six hours detention) was constructed to replace the inadequate wooden settling tanks. A new brick chemical feed house was also constructed. The basin is still in use. The chemical feed building, constructed in 1922, now houses chlorinators, ten chlorine cylinders and a very up-to-date meter shop.

About the time Mr. Godwin became Water Works Manager in 1935, the TVA was nearing completion of Wheeler Dam. This dam takes its name from the Confederacy's General "Fighting Joe" Wheeler whose home and plantation was nearby. The impoundage of Wheeler Lake did not threaten to inundate the plant site but did present several physical and sanitary problems. To correct the situation, a complete raw water pumping station and 4 M.G.D. filtration plant was constructed. The original raw water pumping station was also retained and modernized.

The new plant completed in 1937, met the City's needs unitil 1949, when a 4 M.G.D. addition was made. A 1 M.G. elevated tank and mains constructed in 1946, helped to maintain adequate water and pressure over the system. The expansion program in 1949, included the construction of the 2 M.G. elevated tank, and a considerable amount of 6 inch to 16 inch cast iron mains. An 8 inch main of Molox ball and socket river crossing pipe was installed across the Wheeler Lake.

The rapid development of residential areas and the location of new industries indicated by 1955 that additional water facilities would be needed in the near future. In 1957, Polglaze and Basenberg, Consulting Engineers, Birmingham, presented their report relative to needed expansion. Based on this report plans and specifications were prepared. In October, 1959, the 4 M.G.D. additions were completed. This brings the total capacity to 12 M.G.D., based on two gallons per minute per square foot of filter sand area and six hours retention in the settling basins. The facilities were so designed that the raw water pumps can be easily altered, and an addi-



New pump room completed in 1959: The sight well is located in the foreground; 4 service pumps rated at 6 M.G.D. are also shown. Note the shining brass and the clean, waxed floors.

tional settling basin and filters may be constructed to increase the capacity to 16 M.G.D. During the latest expansion program, two new 1 M.G. elevated tanks were erected. Due to expansion and the highway construction program much new pipe 6 inches through 24 inches has been installed.

Two raw water intakes, one of which extends to the old river channel, modern chemical feeders, rapid mixers, mechanical flocculators, filter bed wash agitators, indicating and recording gauges for all tanks, chlorine residual recorders, and good laboratory equipment are some of the features making this a most modern water filtration plant.

The plant is operated and maintained by a crew of four operators and a superintendent (one operator per shift). Because the operators are especially proud of their plant and its operating efficiency, they are unusually industrious keeping the service pump area, chemical laboratory and pipe gallery (the hard working areas) exceptionally clean and polished. Rightfully, they maintain, the appearance reflects the quality of the plant and its operation.

The chemical control laboratory includes an Enslow stabilizer that checks the "finished" water at one-half hour intervals. One of the chlorine recorders is shown at the end of the room. It is checked several times a day to insure proper operation.

MSD Votes New Tax But Reduces Some Rates

The Board of Trustees of the Metropolitan Sewer District voted May 10 to levy a 4c ad valorem tax to finance maintenance and general operations, and to reduce tax rates in three bond issue subdistricts. After an open hearing, the board heard from its special subcommittee and took the action required to finance the operations of the District.

The 4c ad valorem tax will be supplemented by a service charge of $4.60 annually ($4.00, if paid within 15 days after billing) for each single family residence. A service charge for unmetered multiple dwelling units would require the payment of $3.45 ($3.00 net) for each unit in apartments, flats and rooming houses. Commercial, industrial and other large water users will be billed on a water consumption basis adjusted for the amount of water actually put into the sewers under the proposed service charge.

The 4c tax rate, together with the new schedule of service charges adopted by the board, will increase the income of the Metropolitan Sewer District by an estimated $207,750. The new schedule of service charges will bring in $1,968,750 instead of the $2,834,200 produced last year. The new 4c tax is expected to yield $1,073,200.

Board Chairman Frank L. Ramacciotti said the board believed the new rate, adopted after extensive studies by consulting engineers and comparisons with the rates of other large cities, was the soundest and most equitable method of levying necessary sewer taxes.

"Operating under the old rate, based upon the size of a water tap or meter, developed many inequities. Some families and other water users were overcharged, some did not pay enough and some did not pay at all. The recommendations adopted are those of Horner and Shifrin of St. Louis and Havens and Emerson of Cleveland, Ohio, consulting engineers engaged by the Board to make the study."

Ramacciotti emphasized that the rates would not permit the Sewer District to undertake as extensively planned, the engineering and the acquisition of sites necessary for the treatment and abatement of sewage and waste now being dumped into the Mississippi and Missouri Rivers. Other maintenance projects and emergency flood work also would have to be partially deferred until a later date when additional funds would be available.

New Mexico To Begin Watershed Study

The New Mexico State Planning Office was granted $15,480 in federal funds for a pilot study of an upland watershed development in the Penasco-Dixon area in Rio Arriva and Taos counties. Six state and two private agencies will match the federal grant for the seven-month study, expected to be extended to one year.

The State Planning Office disclosed that the study would survey all of the potentialities for the full development of forest utilization for wood products and other resources of timbering, and for the possibilities for small-scale industrial development and some agricultural uses.

Fifty-First Annual Meeting Attracts 570 at . . .

Illinois Section AWWA, Chicago, Ill.

STAFF REPORT

Meeting in Chicago's Pick-Congress Hotel March 16-18, the Illinois Section AWWA had an information-packed program featuring discussions on demand rates, sewer service charges, safety, water utility advancement, treatment and operator problems. Newly elected section chairman J. C. Vaughn tabbed increased membership the primary goal during the next year.

■ **Demand Rates in Water Utilities** are discussed by Arthur Rynders, Supt. Water Department, Milwaukee, Wisconsin. Peak demand concurrent with the peak loading should be charged for accordingly. Extra system capacities required, therefore, must be paid for. At Milwaukee, payment is based on water use plus a charge for the necessary capacity. A unique demand meter is in service which provides remote tape recording and totalizes water used. The instrument has been installed on a rental basis for four customers and has resulted in the institution of conservation practices. Real savings are shown when totals are compared with those of customers who make no attempt to control water use.

A seasonal water consumption survey relative to air conditioning use has been made with the recommendation that surcharges be made to those users. Actual charging has been held in abeyance pending clarification of pertinent regulations. Mr. Rynders believes that the future will show an increase in assessment of demand charges.

Service Charges on Water Bills are discussed by J. H. Hunter, Commissioner of Public Property, Springfield, Illinois and E. J. Tobin, Commercial Manager, Water and Sewers, Waukegan, Illinois.

Mr. Hunter's paper was presented by Charles Nelson, City Engineer, Springfield, Illinois. The Springfield sanitary district was authorized by referendum in 1924. Soon after this, the first large interceptors in the city's perimeters were planned and ultimately completed. At the same time, Springfield was contemplating a new source of water supply, eventually located at Lake Springfield on Sugar Creek, southeast of the city. The sewage treatment plant was completed in 1929 and, with the combined sewage system, ultimately became overloaded. In an attempt to establish funds to provide adequate sewer service, sewer service charges were added to water bills in 1954. Due to much dissatisfaction and many protests, the authorizing ordinance was repealed after six months operation.

Sewer service charge was again applied in 1956, with collection of more than $600,000 during the last fiscal year. Bonds have been sold which cover sewage treatment plant expansion and trunk and overflow sewers. Expansion (cost $1,000,000) increased the capacity to 16 mgd. This is adequate during the winter months; however, during the summer, capacity is exceeded. The combined sanitary and storm drainage system in Springfield permits overloading and the passage of raw sewage to streams during abnormal periods of flow.

The sewer service charges added problems and complaints to the water department. Customers are concerned about: how long the sewer charge will be applied; whether their water consumption is as high as the bill indicates; that basements still flood even though sewer service charge is being made; that water not going into sewers should not be charged for; and there is resentment over paying for sewers for the benefit of subdividers.

Combined sewers are prohibited by the State Sanitary Water Board and the Springfield Sanitary District has constructed none during the past 30 years. Subdividers presently are responsible for new sewer construction and must receive a permit from the state sanitary water board.

Mr. Tobin described the "Waukegan Way" pointing out that the period 1945-1953 saw water accounts increase over 50% which constituted a strain on both the water and sewage systems. Since the sewage problem was most serious, it was the first to receive attention. The water and sewage departments were combined in 1951 and issued combined bonds. The sewer charges are not shown as a separate item on water bills which Mr. Tobin believes is effective in complaint reduction. New customers pay water and sewer connection charges. The combined department operates under one committee of the city council giving a minimum of political responsibility.

Experiences with the Electronic Computer in Water Supply Problem Analysis were discussed by E. M. Chastain, President, Midwest Computer Service, Inc., Decatur. Presented by G. M. Blanke, Engineer with Clark, Daily and Dietz, the paper related experi-

ences in using digital computers to solve water and sewage calculating problems, particularly those involving flow analysis. Use of the computer can result in savings by reducing desk calculator time, meeting project deadlines and manhours involved. Computer users can participate in program exchanges, useful in adapting specific problems for computer programming. Typical problems suitable for computer calculation are: solution of the Hardy Cross problem, calculations for cost of pipe in place for drainage systems, total costs for all lines in sewage collection systems, and backwater collection data for streams. In the latter case, solutions may be calculated for conditions up to one mile upstream.

Safety Practices

A safety color film was presented which described U.S. Navy safety procedures for workers in or near poisonous atmospheres. Entitled "Industrial Hygiene and Safety — Breathe and Live", the film listed the precautions which should be taken when working in confined spaces, using toxic solvents, paint, and with welding equipment. Observers are cautioned to use protective gear and provide sufficient ventilation, and to test void areas for absence of poisonous vapors. Use of sampling devices and the several types of respiratory devices was illustrated.

Lack of Oxygen in Tanks, Manholes and Excavations was discussed by Paul Sheppard, Utilities Section, National Safety Council. Examples were given of asphyxiation and suffocation where serious injury, and in one case death, resulted from improper attention to safety precautions. Mr. Sheppard discussed the shortcomings of each of three accident analyses and suggested five steps which should be followed and considered basic to any safety program: Personnel should be fully trained in safety procedures; use oxygen deficiency indicators or test lamps, provide adequate masks for the jobs to be done; use lifelines and teach artificial respiration procedures to all employees.

Lack of Oxygen in the Plant was discussed by Mr. T. D. Nulty, South District Filtration Plant, Chicago, Illinois. Asphyxiants include chemicals, aerosols, mists and dusts, and compounds representative of this group. Paint solvents, gases from internal combustion engines, chlorine, dry chemicals, ammonia and liquid fluoride require that plants should be equipped with detection devices, protective gear and all employees should be well versed in treatment of exposed personnel. Slides illustrated dust masks, cartridge type respirators for chemicals, hose mask, and self-contained oxygen supply and oxygen-generating type respiratory protective gear. Mr. Nulty recommended the use of equipment approved by the Bureau of Mines and emphasized the importance of training operators in the selection and use of the appropriate equipment.

New Systems

Peoria taps the Illinois river, a plant description presented by H. J. Carlock, American Water Works Service Company, Inc., Philadelphia, Pennsylvania. In 1869, Peoria constructed the first water plant on the Illinois River. In 1889, private interests developed a ground water supply which was completed in 1892. Wells were subsequently added along the river and at other locations in the community. Chlorine and fluoride are added to the supply and with 170,000 population the ground table has dropped requiring artificial recharge wells using chlorinated river water. A new plant was constructed having a capacity of 10 mgd and using two circular clarifiers with perimeter filters.

Provisions for chemical feed include rotometers for liquid alum, volumetric feeders for hydrated lime and activated carbon, pre and post-chlorination, and pumps for hydro-fluosilicic acid. The settling tanks are equipped for automatic sludge withdrawal on a timed basis. Operated from a centralized control panel in the pump room, the plant has pneumatic instrumentation which controls a butterfly valve in the raw water supply line from water level over the filters. Back washing is automatically triggered from loss of head and can be controlled remotely or locally as necessary. Constructed for a total cost of $1.35 million, the plant can be expanded to 45 mgd at the present site.

Improvements at Quincy's Water Plant were described by W. R. Gelston, Supt. of the Water Commission, Quincy, Illinois. Equipment to permit softening of the water at Quincy's plant was added in 1931 together with equipment for practicing breakpoint chlorination. Plant capacity had become overloaded and considerable study was given to the possibility of developing a new plant location. Lacking a suitable new site, it was decided to reconstruct the plant on existing site and provide presedimentation for the raw water. A triple deck unit was built for this purpose and slides illustrated stages in the modernization program and the results after construction.

Water Utility Advancement

A model panel moderated by E. R. Healy, Northern Illinois Water Corp., pointed out deficiencies in reservoirs and ground water supplies. Undermanned plants and underpaid personnel imply poor management and indicate needs for solution. Basic questions are further concerned with the magnitude of difference existing between gas and power utilities and water utilities. Water utilities generally fail to point out needs to the public through proper public relations and educational programs. Water has been considered to be free. Taken for granted, the benefits of adequate water supply are not really known by the consumer. It was suggested that utility managers start with school children, give tours and use descriptive leaflets. A utility should make every attempt to improve and modernize record keeping systems and obtain adequate managership, and use consulting engineers and public health department surveys in developing plans for the future. Water utilities should have adequate rates to cover costs and amortize investment. Financing ought to be on the revenue basis and water utilities should accept

their responsibility. Panel members were V. E. Fishburn, Burgess Cellulose Co., Freeport, Illinois; D. M. Maxwell, Alvord, Burdick & Howson, Chicago; Clifford Fore, Illinois Cities Water Company, Mt. Vernon, Illinois; William Ackerman, Illinois State Water Survey.

Treatment and Distribution

Effects of Phosphates on Coagulation and Sedimentation of Turbid Waters were discussed by James J. Morgan, University of Illinois. A controlled study of a synthetic raw water containing builders used in detergents was described. The components, were added to the synthetic water in concentrations found to be prevalent in Illinois streams. This level was found to be less than 0.5 ppm. This and higher concentrations were used in the one gallon per minute pilot plant studies. The findings are that trisodium phosphate and tetrasodium pyrophosphate can produce some interference in continuous flow water treatment plants. Their concentration can be reduced by increased coagulant feed (either aluminum or iron salts). The study showed that ortho-phosphates did not interfere with the normal coagulation of raw water.

Circulation of Water in a Distribution System was discussed by T. E. Larson, Illinois State Water Survey and J. C. Guillou, University of Illinois and Laurel Henley, Illinois State Water Survey. They reported a precise study of conditions in the Hammond, Illinois distribution system. It was pointed out that water treatment must be compatible with conditions known to exist in the distribution system. At Hammond, it was found that slime growths, aluminum and magnesium carryover, together with corrosion, resulted in red water. Basically, successful chemical treatment requires mechanical assistance if adequate protection of the distribution system is to be achieved. Dead ends should be omitted and turbulent flow should be maintained throughout the system. Prof. Guillou described the Hammond distribution system in detail and indicated solutions to the network analysis problems and the changes made to improve the flow and establish turbulent flow conditions. Cost estimates were also given for correcting system deficiencies.

Operators Forum

Tank Maintenance was discussed by E. E. Alt, Chicago Bridge & Iron Company. The evolution of elevated tanks was discussed and Mr. Alt counselled that a good maintenance program is essential from the inside out where elevated tanks are concerned. Regular inspections should be performed by capable organizations, preferably suppliers of the tank. He recommended that users follow the AWWA tank painting specifications, using the standard aluminum exterior paint which presently is also available in pastel shades. Properly designed installed and maintained cathodic protection systems are satisfactory, he stated.

Chemical Feeding Problems were outlined by Oscar Gullans, South District Filtration Plant, Chicago, Illinois. The use of activated carbon at 1.5 pounds per gallon has shown to be very practical. Slurry storage saves space and feeder capacity and simplifies the chemical handling problem. Ferrous sulphate, used at South District Plant, is waste pickle liquor, subjected to filtration through course fabric filters to remove foreign matter which could interfere with handling and feeding.

Hydrofluosilicic acid feed has been changed from the use of plunger to diaphragm type pumps having visible flow check valves. Bubbler type level gauges in the acid storage tanks are being replaced with float-operated units. Mr. Gullans reported studies of pelletized sodium silicofluoride in an upflow saturator. A 5% alum solution was provided to increase the pellet solubility though fines were found to carryover during backwashing of the unit.

Pelletizing added to the chemical cost although the feeding method proved to be satisfactory. Fluoride has also been fed in slurry form containing two to three percent solids of minus 200 or 300 mesh material. Material could be stored at a 70% concentration and fed with pumps at 0.2-0.3 gpm.

Lime has been receiving much attention at the South District Plant in an attempt to solve handling and feeding problems associated with quick-lime. Experiments with hydrated lime as a 40-50% slurry have involved studies of tanks, mixers, pumps and necessary appurtenences to feed a slurry through 600 ft. of one inch plastic pipe. A negligible carbonate coating has been encountered in handling slurry of this concentration. More experience is required before selection of mixers and pumps can be made. Ammonium sulfate handling has been difficult due to arching, lumping, and other handling problems. Anhydrous ammonia has been selected as an improved chemical and will be stored and fed as a gas.

Mr. Gullans described experiments with storage tank linings. These are continuing, although one failure of sheet plastic has been noted due to lack of adhesion to a concrete storage tank wall. Thus far, epoxy and fiberglass 12-20 mils thick has proved satisfactory.

Peak Water Demands in two small water systems were described by Richard Schlaack, Miller Artesian Well Co., Brookfield, Illinois. Winter demands on well supplies start at approximately 6:00 a.m. and reach a peak at 8:00 to 10:00 a.m. on Monday morning. Demand tapers off after 6:00 p.m. with slight peaks and valleys the remainder of the week. No great demand on the system was noted during Saturday operation. In the summertime, a distinct increase in per-person consumption is noticed and only minor changes in consumption peaks from winter operation were noticed. It was noted that higher priced homes on larger lots tended to use larger volumes of water.

A Subdivision Water Supply was described by L. J. Morgan, Citizens Utility Company of Illinois, Roselle. In the development of water supplies for rapidly growing areas, it is essential to work closely with the developer to size the distribution system and provide the wells. Mr. Morgan's company buys the systems from the builders after getting approval from the health department and

Clifford Fore, manager, Illinois Cities Water Co., Mt. Vernon, Ill.; Victor E. Fishburn, President, Burgess Cellulose Co., Freeport, Ill.; Donald M. Maxwell, Alvord, Burdick & Howson, consulting engineers, Chicago, Ill.; William Ackerman, Head, Illinois State Water Survey.

utilities board. They prefer to start with two wells on a system instead of one, and to provide ample storage (elevated tank), large feeder mains to provide for future expansion, a well planned, neat pump house with auxiliary power for one of the wells, and gas chlorination.

Applications of Small Meters were described by Mr. J. H. Kuranz, Water Utility, Waukesha, Wisconsin. Meter maintenance is greatly simplified if procedures in standard meter maintenance handbooks, and the AWWA meter maintenance handbook are followed. Recommendations are to calibrate and test all new meters as well as repairing and testing and calibrating used meters. The heart of a good meter maintenance program is in the training of capable meter repairmen. New tools and equipment have been developed to facilitate inspecting, calibrating and testing meters and make the job easier and more efficient.

Operating Economy

Effective Economies in Water System Operations were described by Leo Louis, Gary-Hobart Water Corp., Gary, Indiana. This slide lecture began by illustrating the use of modern chlorine handling equipment and the use of the MF filter in connection with main sterilization. This method permits a savings in time, permitting mains to be returned to service more rapidly. The use of centralized monitoring equipment for outlying tanks and stations permits continuous attention. Outlying stations should be protected from vandals by locking, providing steel shutters over the windows and fencing where possible. On the distribution system, Mr. Louis discussed the use of augering equipment to install pipes under roads, highways and railroads, for casings and in laying service lines. The use of two-way radio for dispatching is increased in efficiency if the dispatcher has a map and card file readily available.

The meter maintenance shop showed a modern degreaser, sand blaster which permits the operator to hold small parts while cleaning, modern meter benches and testing equipment. Finished meters are stored on pallets to facilitate handling and moving about. Billing at Gary-Hobart has been changed from monthly to bimonthly with resultant savings of approximately 50%. This could be a difficulty from the customer's standpoint but most objections are overcome by overprinting the bill in red letters "for 2 months".

The use of mechanical office equipment such as a billing machine and elevator file has resulted in much time saving and increase in efficiency. Mr. Louis suggests that all water utilities keep up with changes and improvements and shop carefully to get the proper device for any particular problem. Modern billing machines provide tapes for permanent record and rate and bill frequency analysis. He has also found a copying machine to be a very valuable piece of equipment.

San Jose Invites Bids for Water System

Bids are invited for construction of a water system for the City of San Jose, Costa Rica, the Bureau of Foreign Commerce, U. S. Department of Commerce, recently reported.

Public bid No. 144 of the municipality of San Jose authorizes the municipality to contract for a loan with one or more companies in an amount of $3,000,000 for construction and improvements to its metropolitan water system. The work to be performed should follow Phase 1 of a report prepared by Rader and Associates, Miami, Florida.

To cover the obligation, the Government of Costa Rica will guarantee the municipal bonds to be issued by the City of San Jose in the amount of $3,000,000, bearing 7 per cent interest annually for a period of fourteen years, and to be amortized semi-annually.

PHS To Tabulate Pollution Fish Kill

The Public Health Service has initiated a nationwide system of reporting the frequency and locations of fish killed by pollution. In making the announcement, Surgeon General Leroy E. Burney said that he had written to all state fish and game conservation agencies, asking them to provide continuing reports of fish killed by pollution as these occur in the nation's rivers, lakes, and coastal waters.

Reports will be made directly to the Public Health Service in Washington. Upon receipt, copies will be made available to the Fish and Wildlife Service of the Department of Interior which is cooperating on the project.

This is the first time that a national tabulation of the numbers of fish kills has been undertaken. Dr. Burney said the project will be an effective means of obtaining additional basic information needed to determine the effects of pollution on the nation's water resources, as required by the Federal Water Pollution Control Act.

The Public Health Service will publish quarterly and annual reports of fish kills, listing numbers, locations, and causes, when known. The reports will be distributed to the cooperating agencies, organizations, and individuals who request them.

300 attend spring meeting . . .

New York Section AWWA at Binghamton

The new Sheraton Inn at Binghamton was the site of the annual spring meeting of the New York Section AWWA. Approximately 300 members and guests attended the meeting which coincided with the dedication of the city's new Webster Street Water Treatment Plant. The group named C. M. Taylor, Oneonta, N. Y., as their new chairman and announced that the Fuller Awardee was Mr. Alfred Roberts long-time active member and president, Wanakah Water Company, Hamburg, New York.

Water Works School headed by G. E. Symons, PhD., Consultant, Larchmont, New York. The regular introductory session for New York Section's technical meeting is the Water Works School at which important administrative phases of water works operation are studied. G. E. Symons discussed the three P's of speech-making, the planning, preparation, and presentation phases.

Public relations was discussed by W. T. Brady, Consolidated Edison Company of New York, New York, specifically speaking on "Reaching the Public Through the Press". ConEd has had success using newspaper display advertising on a repetitive basis to help establish a corporate image. Announcements are geared to inform the reader that an organization is competent, that it has problems, and is engaged in constructive projects. It is important that the questions of reporters be answered, preferably by the best informed person available in the organization.

Details of the movie "Priceless Water" produced for the Long Island Water Corporation by Dana Productions were described by Hans Pederson, President, Dana Productions, Inc., New York City. Background and aims of the movie were described by the water company's Chief Engineer, Michael Zihal. Movie production follows much the pattern of any endeavor wherein a plan is outlined and, in the case of a special purpose film, offered to organizations specializing in this type production. Four phases are normally involved, beginning with the proposal, followed by idea exploration, script selection, and examination of cost data. The script phase includes the preparation of a motion picture to fulfill the needs and may include four or more drafts before arriving at a final formal presentation. The production phase includes the actual shooting and exposure of film on the sites selected, editing and mixing of the sound track together with the film. The post-production phase includes follow-up information regarding the number of showings, number of viewers and supplying of copies. Thus far, "Priceless Water" has been shown an average of two to five times a month before 800 people.

"Management Schools and Communication Techniques" were discussed by H. E. Hudson, Consulting Engineer, Hazen and Sawyer, New York City and Edward Griffin, Johnson City, New York. They pointed out the success of the Cazenovia Management School held in the fall of 1959. Schools are designed to point out ideals and identify water works management needs. The person attending must recognize how it applies personally to his program and then act accordingly. Communications, the subject at the Cazenovia school, described means by which negotiations with employees can be carried on most effectively. The 1960 Management School will be held at Colgate Inn, Colgate University.

Remote Control of Water Supply Systems including monitoring and telemetering was discussed by Addison Davidson, Jr., Femco, Inc., Fountainville, Pennsylvania. Of the wide range of activities covered by various water systems, all have one common element, namely customers. The collection of remote information and transmitting it to a central location involves specific information regarding quantities and the monitoring of on-and-off operation of various units. Several devices currently available utilize alternating current pulse wherein a designed frequency for each function is transmitted over a single line pair having class A characteristics and a maximum range of 3000 cps. Slides illustrated the adaptation of direct current telemetering to audio tone for reservoir type level and station information to be transmitted to a central office. Audio tone units have proved to be reliable and require minimum maintenance.

Circuit scanner utilizes a single pair of wires, direct current and audio transmissions simultaneously. Magnetic switches are scanned every two seconds to provide multiple signals of varying types. Application of this type equipment should include the study of present needs, plus anticipation of future requirements. Transmission line costs vary between telephone companies; however, they are usually based on the distance lines must be run from the local exchange.

Economics of Modern Methods of Analyzing Water Distribution Systems was presented by D. E. Stearns, Dr. Annabel Tong and Dr. W. O. Lynch, Consulting Engineers, Cazenovia, New York. The search for practical means of solving network analysis problems also includes study of the economics of the several means available. A nomograph based on Hazen-Wil-

liams formula was described which could be used on flows of 15 to 16,000 gpm, and its use on a small system, (Phoenix, N. Y.) was illustrated. The computation sheet included three corrections to arrive at the final system flow balance. Also presented were examples of studies using the McIlroy Fluid Network Analyzer wherein voltage drops and current flow are analagous to water flow. It was suggested that digital computers are valuable in solving problems requiring repetitive calculations. Fundamentally, all calculating methods depend on the successful execution of basic field studies. These in turn involve availability of a good system map, system checking and determination of the C-value which may more properly be called "behavior value" of a given system.

Municipal Civil Service was described by H. J. McFarland, Municipal Service Division, State Dept. of Civil Service, Albany, N. Y. Basic requirement for manpower consists in the availability of competent people. He believes that men, money, materials, management and public relations are the five points which must be present in any successful operating organization. Personnel must possess knowledge skill and ability of a level sufficient for their assignment. Good employee relations indicate that management must know elementary rules relating to employees. These include their working conditions probationary periods, trainee positions and a written job specification describing what the employee is to do. He should also be advised how he is to do it and be aware of available fringe benefits.

Valve Maintenance and Valve Records for a small community were discussed by E. M. Griffin, Johnson City, N. Y. The system described was based on AWWA recommendations presented in 1953. Distribution system is 50 miles long, containing 1200 valves and 360 hydrants. Basically, three types of maps are maintained for this system. One over-all map scaled 500 ft. per in. is used for comprehensive area coverage. Sectional maps, scaled at 100 ft. per in. are used to describe definite areas in the system while the detailed, or plot within a section, maps are produced in book form, scaled 20 ft. per in. Notations on the detail maps identify valves, hydrants, number of turns and direction to open. Also contained in the book are sheets on which valve inspection records are kept and sheets for recording flow tests and other hydrant data. Manuals have been prepared which establish inspection standards and inspection procedures for valves. An accurate spare parts inventory is maintained, and all office records are kept up to date.

National Clay Pipe Mfrs. Hold Annual Meeting

G. A. Robinson, President, announced that the National Clay Pipe Manufacturers, Inc., reelected the following officers at the 1960 Annual Meeting held in Washington, D.C.: G. A. Robinson, President; A. J. Reed, Vice President and Director of Research; D. M. Strickland, Vice President; A. G. Cochran, Secretary; and R. G. Scott, Treasurer.

During the meeting of the Association, a number of industry-wide research projects and a streamlined advertising and promotional program were revealed to the 70-odd manufacturers attending.

Heading the list of research developments at the NCPMI Research Laboratories, Crystal Lake, Illinois, are the revolutionary new factory-made joints. These joints, which are already in use, are not only designed to reduce the time and cost of installing clay pipe in the ground, but also reduce infiltration to the lowest possible amount and stop root penetration. New studies being conducted are expected to make vitrified clay pipe even more efficient.

Besides the new research developments, the Crystal Lake facilities will continue a general program of study into such matters as impact and crushing strengths, dimensional control, flow factors, a new liner for concrete pipe, and development of an air test for sanitary sewers.

R. H. Holl, Chairman of the Advertising Committee, announced that, after more than a year of study, the Committee had voted to combine the Association's advertising and public relations efforts in one Washington agency in order to make the industry's promotional program more efficient. Holl reported that J. Gordon Manchester Advertising, Inc., will handle the new program.

President Robinson also announced that the Fall meeting will be held at Boulder, Colorado, the week of September 25.

Miller Retires from PHS

Arthur P. Miller, a native of Steelton, Pa., and a sanitary engineer of the United States Public Health Service for almost forty years, retired on May 31. He entered the Public Health Service in 1920 as a civil service employee and was commissioned in the Regular Corps on September 5, 1930.

His assignments have covered the complete range of public health engineering activities. He conducted investigations of water supplies in Tennessee in connection with outbreaks of typhoid fever; he was chief engineer of the Kentucky State Board of Health in Louisville; and he has worked with Interstate Sanitary Districts Nos. 5 and 6 in San Francisco, California. During the three years spent in California, he worked on the design, construction and operation of sanitary works in Yellowstone, Glacier, Rocky Mountain and Yosemite National Parks and was in charge of the general sanitation and mosquito work in these parks.

At PHS' Washington headquarters, Mr. Miller has served as engineer in charge of Interstate Sanitary District 2, handling water, vessel and shellfish investigational work and sanitation surveys. At present, he is Program Officer in the Office of the Chief of the Service's Bureau of State Services.

Among his many other activities, Mr. Miller was chairman of the publications committee of the Federation of Sewage Works Federations, and is a member of the American Society of Civil Engineers, and the American Water Works Association.

Timely feature of the N. Y. Section AWWA spring meeting was . . .

Dedication of Binghamton's New Water Filtration Project

A STAFF REPORT

EDITOR'S NOTE: Perhaps the proudest registrant at the New York section AWWA's spring meeting was Mr. Grover E. Rickard, Binghamton's Water Bureau Superintendent. The reason is that his plans to have the new $3.7 million filtration project completed for dedication during the meeting were realized. Many section members and guests took advantage of the opportunity to attend the dedication and inspect the excellent new facility.

MAYOR JOHN J. BURNS officiates as new Binghamton Water Project is dedicated. High School bands, citizens and N.Y. Section AWWA members attended.

■ BINGHAMTON, NEW YORK, faced with the same problem as most other U.S. communities, realized that something had to be done if its Water Bureau could be expected to serve the 105,000 population it expected by 1975. Something *was* done, and the result of such planning and work was visible when the new Binghamton Water Filtration Project dedication wound-up the New York section AWWA's 1960 Spring Meeting. Without question the outstanding event of the meeting, the dedication also climaxed many years of progress by the Water Bureau.

Ninety years ago, the Village water supply simply consisted of several public and many private water wells. Following incorporation as a city in 1867, a board of water commissioners acquired water front property on the Susquehanna River. Here, supply wells and a pumping station were located. Mains were installed and water was delivered through them in 1868. Population growth and system expansion led to building the city's first filtration plant, completed in 1902 and rated 10 mgd. It was modernized in 1939 to include a mixing chamber and added settling capacity. In addition, new steam boilers and steam-driven pumps were installed. Also, several wells were placed in service, including one drilled well with an automatic hardness removal plant. The wells were used until 1948 to supplement the river water.

Distribution System Improvements

Four covered 2.5 mg pre-stressed concrete reservoirs were constructed in 1951-52 followed by a fifth (250,000 gal.) reservoir of similar construction in 1953. This program provided both storage capacity and pressure for the system, and permitted the abandonment of an old, 5.0 mg open reservoir. High service pumps were converted to electric operation in 1953. The conversion to electricity saved $60,000 in labor costs for pumping station operation.

New Water Filtration Project

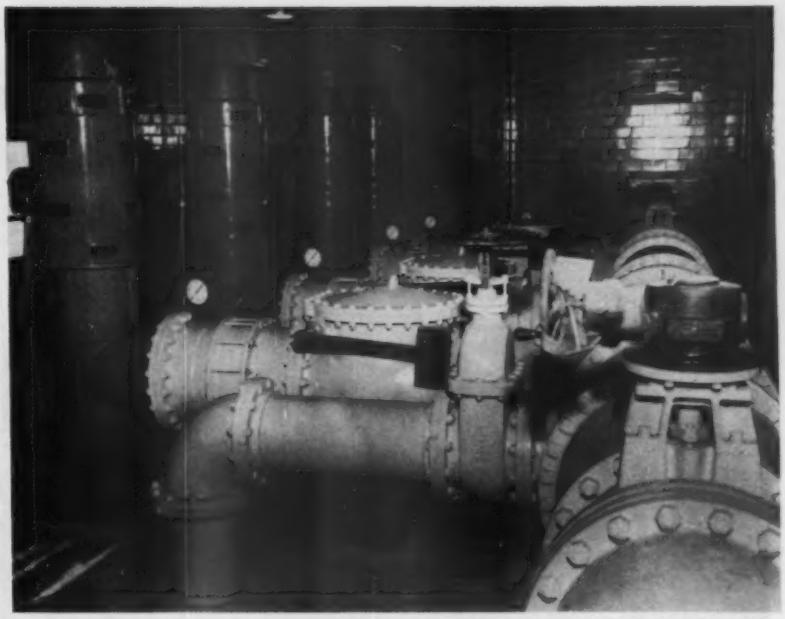
All of Binghamton's water supply will be produced at the new site, located across the river from the retired 58-year old Court Street Plant. Water is drawn from the Susquehanna River through an intake channel, a coarse bar rack, a ⅜ in. mesh traveling screen, and then pumped

to a rapid mixing unit. Following the addition of chemicals, lime and liquid alum at present, with provision for activated carbon, flocculation and sedimentation condition the water for filtration. Filtration is followed by chlorination, and clear-well storage. Chlorine dioxide is used when necessary to combat phenolic compounds.

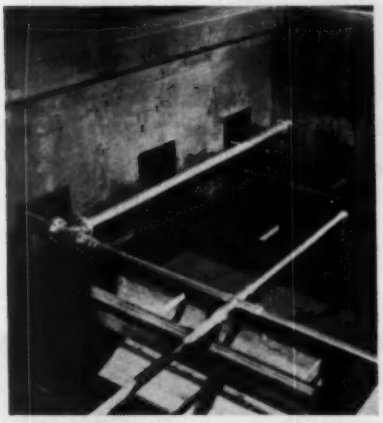
The new intake station contains four mixed flow pumps having 30 mgd maximum capacity, plus a fifth unit for discharging filter back wash water to the river during high water periods. Located in the Chemical Storage Building are volumetric dry feeders for granular alum (5-100 pph), hydrated lime (5-100 pph), activated carbon (2-25 pph) volumetric liquid feeder for liquid alum (1-25 gpm) and a standby feeder for the dry chemicals. Chemical feeders are arranged to operate automaticaly proportional to plant influent. Substantial area in the building is provided for chemical storage. Chemicals and raw water are mixed by 10 HP weatherproof motors driving twin turbines.

Four flocculation tanks are provided, each containing paddles arranged for three-stage mixing. Paddles are eleven feet in diameter and may be operated at peripheral speeds varying from 0.7 to 2.0 fps. Flocculation detention time is 45 min. at 20 mgd.

Sediment is removed in four longitudinal clarifiers which contain continuous flight-type sludge removal equipment. Detention time is 3.5 hrs. at 0.8 fpm flow velocity. A unique



FOUR LOW LIFT PUMPS in raw water pumping station. Pumps are deep well turbine type having combined capacity of 30 mgd. Note manually operated butterfly valves in discharge manifold.



SURFACE WASH piping and fiberglass reinforced plastic wash water troughs installed in rapid sand filters. Four 12'8" rotary distributors apply surface wash water to each filter.

View of settling basins showing ice on surface. Filter building is in background. Note chlorine container monorail and exhaust fan outlet at left end of filter building.

SPACIOUS FILTER GALLERY in new Binghamton filter plant, showing operating consoles. Wash water gauge is ceiling-mounted and visible from all consoles.

are smooth-surfaced blue brick, with glass and yellow porcelain enamel panels. Plant structures are independently protected against major damage from high water, although an existing levee protects the site against anticipated floods. Sufficient area is available, and the plant has been designed for a future 50% capacity increase.

Design and Construction

Project plans were initiated in 1956, with construction beginning in January, 1958 under the administration of John J. Burns, Mayor.

The improvement program was under direction of R. C. McNamara, City Engineer, with assistance from Supt. G. E. Rickard, who will operate the new plant. Project design was a joint consulting engineering venture of Leonard S. Wegman Company and Alexander Potter Associates. Smith, Howard and Sprague were the General Contractors.

outlet arrangement for each tank includes 120 ft. of V-notch weir providing 38,000 gpd per foot.

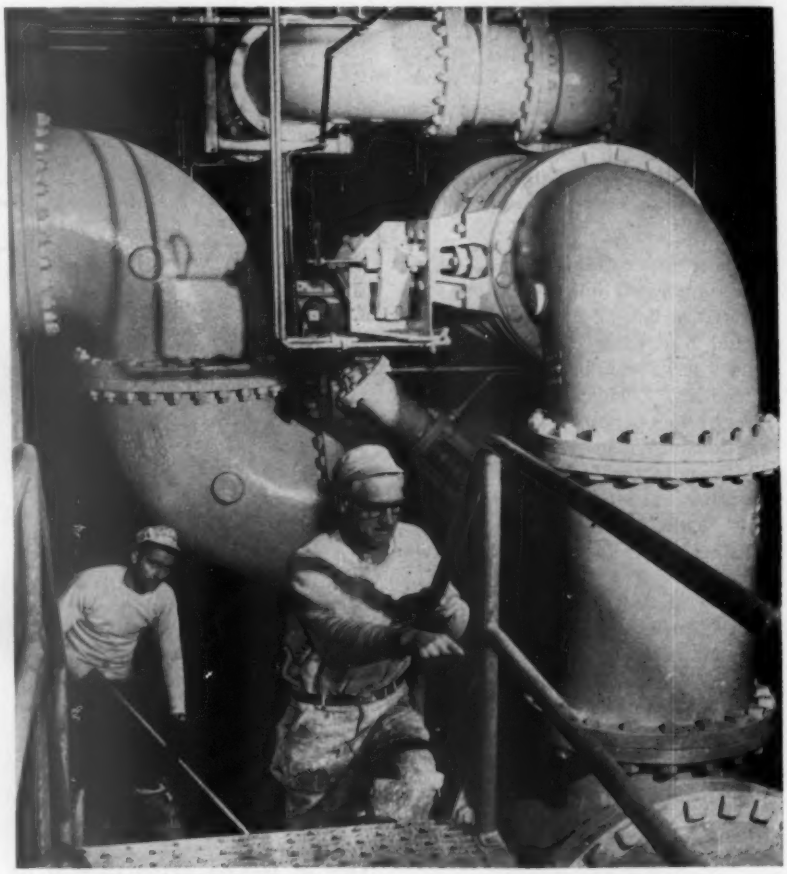
Filter Building

Plant operation is conducted from the filter building which houses the laboratory, offices, control panel, repair shop, electrical switchgear, locker room, high lift pumps and rapid sand filters. The 1.3 mg clear-well is located directly below the filter section of the building. Each of the ten filters is rated 2.0 mgd, and has its own operating console, rotary surface wash and fiberglass reinforced plastic wash trough. Filter effluent controllers include hydraulically operated valves. Valves 16 in. and smaller are gate valves, while butterfly valves were selected for application 20 in. and larger.

Facilities for pre and post-chlorination are located in the filter building, together with chlorine dioxide generating equipment; arrangements are also included for future fluoride application.

Four high lift pumps have a combined capacity of 31 mgd. Three wash water pumps are each rated 8500 gpm. Leading from the plant to the distribution system is one 30" and one 24" diameter force main.

Buildings have facades emphasizing simplicity, strength and utility. Walls



WORKMEN APPLY finishing touches to pipe gallery. Hydraulically operated butterfly valve is installed in waste water pipe, at right.

Abstracts of papers presented at the . . .

Second Sanitary Engineering Conference—*Part I*

reported by
Prof. BEN B. EWING
Dept. of Civil Engineering
Univ. of Illinois

EDITOR'S NOTE: This conference, held January 27 and 28 at Urbana, Illinois, concerned itself with the many and complex problems of radioactivity in public water supplies that confront the sanitary engineer today. Part I, presented this month, considered radiation and its effects on man and his environment. Part II, to be presented next month, considered radioactivity in water supplies, problems of removal and the problems of monitoring.

■ **Radiological Aspects of Public Water Supplies** was the subject of the Second Sanitary Engineering Conference held in Urbana, Illinois of January 27 and 28, 1960. This was the second of a series of annual conferences sponsored jointly by the Department of Civil Engineering of the University of Illinois and the Division of Sanitary Engineering of the Illinois Department of Public Health.

The subject was particularly timely in view of the recent completion of the Dresden nuclear power plant near Chicago and the enactment of a radiation control law by a recent session of the state legislature. The purpose of this conference was to present to water works people the general problem of radioactivity in water supplies, and to inform them of the work being done by state and municipal agencies in Illinois, as well as throughout the nation, to control the contamination of water supplies. More than one hundred water works superintendents, chemists, state and municipal officials, consulting engineers and students attended the two-day session.

The story of the design and construction of the Dresden plant was presented in an illustrated lecture by J. J. Poer and W. J. Shewski, both of Commonwealth Edison Company in Chicago, at the evening banquet session. The program also included a laboratory session during which demonstrations were given of the various techniques used to monitor and assay waters for radioactivity. R. R. French and R. W. Courtney of the Illinois Department of Public Health, R. L. Weatherford of the State Water Survey Division, and J. J. Streerman and B. B. Ewing of the University of Illinois conducted these demonstrations.

Some of the papers presented at the conference are summarized here. Proceedings of the conference are being published, and a limited number will be available from the Department of Civil Engineering, University of Illinois, Urbana.

What Is Radiation, Dade W. Moeller, Chief, Radiological Health Training Activities, U. S. Public Health Service, Robt. A. Taft Sanitary Engineering Center, Cincinnati, Ohio. Nuclear radiation is a process which accompanies the transformation of atoms from unstable to stable states. The atom is composed of three basic building blocks: the protons and neutrons forming a central nucleus with electrons orbiting about this nucleus. Atoms of different chemical elements have different numbers of protons in the nucleus. Atoms of isotopes of the same element have the same number of protons but different numbers of neutrons in the nucleus.

A variety of atoms are found in nature. Those of the heaviest elements are unstable, the source of their instability being that they are too large. To become smaller, these atoms emit alpha particles made up of two protons and two neutrons. Since the daughter product contains two less protons, it represents a different element.

Fission products, resulting from the splitting of uranium, are also unstable, their instability being due to an excess of neutrons in their nuclei. Through the emission of electrons or beta particles, the excess neutrons are converted into protons. Each such conversion reproduces an atom which represents a different element. After a series of such conversions a completely stable atom is finally obtained. Either alpha or beta radiation may be accompanied by gamma radiation. These are identical, for all practical purposes, to x-rays, and represent only a release of energy.

The rate of frequency of decay of unstable atoms depends both on a fundamental characteristic of that species or isotope and on the number of unstable atoms present. The frequency can be expressed in units of the curie, which is the population of unstable atoms whose frequency of decay is 37 billion per second. Since this is such a large frequency, water monitoring personnel often use units of microcuries (one millionth of a curie) and micromicrocuries or picocuries (one millionth of one millionth of a curie).

As the unstable nuclei decay, the number of unstable nuclei remain-

ing decreases with time. The time necessary for half the unstable nuclei to decay is called the half-life. With the passage of a second half-life, half of the previously remaining half will have decayed. Each radionuclide decays with a specific half-life.

Physiological Aspects of Radiation, John H. Rust, Professor of Pharmacology, Head, Nuclear Medicine, The University of Chicago. In the close proximity of nuclear detonations, damage has been reported taking part in man. Such exposures have resulted in immediate and delayed deaths, delayed carcinogenic (leukemia) response, and radiation burns to men. In all of the cases, radiation levels have been high and the exposure has been for a relatively short time.

There is no direct evidence that the artificially created low level, prolonged, ambient radiation to which the bulk of the world population is now subjected has caused any damage to man or its animals. It has been facetiously estimated that there is more of a human hazard from the heat of the arguments than from the present ambient low level radiation. The wildest sort of biological extrapolations have been indulged in—data valid for a foot are extended to a mile. Data valid for one species of animal is used freely for another unrelated one. Data related to the biological behavior of one radioactive ion is unblushingly substituted—with guessed at or poorly documented fudge factors—for another or substituted even when the mode of decay or half life is radically different.

Yet, this seems to be our only rational course, for we must imagine the worst possible case for the hazards to the public health. As data are developed which give an understanding or a better estimate of the hazard, we must change our estimates. My fear is that invalid inadequate estimates will become frozen into our folk lore. Such an unhappy state of affairs can deprive us of the benefits of nuclear power or devices that we must develop for the future. Tightly held unwarranted assumptions will lead to prolonged and unwise public policy and attitudes.

Environmental Aspects As Applied To The State Of Illinois, C. W. Klassen, Chief Sanitary Engineer, Illinois Department of Public Health. Sanitation of our environment encompasses control measures in seven major fields of activity: water, food, air, shelter, wastes, natural hazards, and man-made hazards. The science of sanitation passed through a "period of justification or fear" where action was primarily justified on the basis of an epidemic or fear of one. Then came a "period of methodization" where prevention was accomplished through development of techniques. We are now in a "period of humanization or socializing" our environment, in that we are concerned not only with the absence of disease, but also the ability to enjoy a more comfortable living in clean and safe surroundings.

In dealing with problems of radiation and the application of atomic energy, the "period of fear" has again made its appearance. Thus, it is natural that the public today looks to its state health department, rather than some Federal agency, for assurance that their environment is protected from any potential hazard. The basic legal responsibility for the protection of the environment rests with the various states.

On the other hand, the official activities of the various state governments have been inspired, for the most part, by the Federal policies inaugurated by the Atomic Energy Act of 1954 which encouraged the public and private interests of the country to participate in a program of developing an atomic energy industry for peaceful purposes. Uncertainty concerning the ultimate development of the new industry and the relative positions of the Federal and state government have precluded extensive state legislative experimentation other than in control of radiation hazards. The main trend has been the increase in the number of statutes which either launch a broad study program or institute a comprehensive system of radiation hazard control.

Administrative and technical problems fall into one of the following categories: (1) Atomic Energy Commission installations; (2) off-commission uses; and (3) shipments of radioactive material into or through a state. Apparently, every effort has been made by the Atomic Energy Commission to prevent hazardous conditions from developing. Of concern is what the attitude of private industry will be in connection with any radiation phase of its operation.

A state's interest and its administrative policies are greatly influenced by the background of events. Some of the events in Illinois which have been important in this respect are the first sustained chain reaction achieved by man at Stagg Field in Chicago, the establishment of Argonne National Laboratories, construction of a uranium-hexafluoride plant near Metropolis, and the completion of the Dresden Nuclear Power Station near Chicago. Many problems involving use of radioisotopes and ionizing radiation have been encountered. Some future problems anticipated include the increased use of isotopes and use of the Great Lakes by nuclear-propelled ships.

The relationship between the State and the Atomic Energy Commission, The United States Public Health and other Federal agencies involved has been excellent. The same is true for industry.

The state is already involved in the environment aspects of the whole field of radiation, and it can discharge its legal and moral obligations in this field and pursue a sound economical and practical approach to these problems of this new and vitally important industry.

Nuclear Energy Industrial Wastes, Joseph A. Lieberman and David C. Costello, Jr., Environmental and Sanitary Engineering Branch, Division of Reactor Development, U. S. Atomic Energy Commission, Washington, D. C. The management of radioactive wastes, which includes their handling, treatment and disposal, is a general problem whose thread runs through the complete fabric of nuclear energy operations. Radioactive wastes in either gaseous, liquid, or solid forms are evolved in essentially all operations associated with nuclear energy facilities beginning with

mining of ore through feed material production, reactor operation, chemical reprocessing of reactor fuels and a wide variety of uses of radiation in medicine, agriculture and industry.

More money probably has been spent, and more scientific and technological effort have been concerned on facilities, operations and research with regard to this industrial waste, than an other industrial contaminant we have known.

The management or disposal of radioactive wastes is not a single problem with a single solution. Billions of gallons of low-level wastes, having a radioactive concentration in the range of a fraction of one microcurie per gallon, are produced each year. On the other hand, the volume of high-level wastes, having concentrations of radioactivity as high as 1000 curies per gallon or more, is much more limited.

According to experts who testified during recent hearings of a Congressional committee, radioactive waste management and disposal practices have not resulted in any harmful effect on the public, its environment or its resources. Low-level wastes are being dispersed into the air, gound and water under careful control. The final disposal of high-level wastes associated with chemical reprocessing represents an aspect that, while safely contained for the immediate future, has not yet been solved in a practical long-term engineering sense. It is the concensus of opinion that temporary tank storage will be an integral part of any ultimate system.

The long-term responsibilities, particularly those associated with the protection of public health, safety and natural resources, must be borne by agencies of the public at various levels of Government, but primarily the Federal. International aspects of the problem are important considerations, particularly in connection with disposal into the seas and operation of nuclear-propelled vessels and aircraft.

While much research, development, pilot-plant testing and field experiment and evaluation have yet to be done before firm engineering conclusions will be possible for all situations, with proper attention to this phase of the nuclear industry, including the research and development program, we believe the industry can develop in a rational way without being "hamstrung" by its own wastes.

Newspaper Tells Stand on Multiple Use of Reservoirs

The Providence Journal-Bulletin newspapers recently modified their stand on the issue of multiple use of water reservoir areas. Although previously opposed to such useage, the publication has recently stated editorially: "New evidence on the problem posed by multiple use of public water and the decreasing supply of land for recreational use have led these newspapers to modify their stand on the restriction on sportsmen.

"There are two factors involved in acceptance of the principle of multiple use of reservoirs and their watersheds under a program of adequate regulations and strict enforcement. The first relates to the issue of pollution; the second relates to the issue of the current rapid growth of the state . . .

"Evidence gathered by these newspapers in recent weeks suggests these conclusions on pollution: 1. Reservoirs and watersheds can be opened under adequate controls and with effective enforcement without necessarily affecting the quality of drinking water adversely. 2. Safety, quality and palatability of water are more important than recreational use of water facilities, and if proper controls and enforcement cannot be maintained, multiple uses ought to be abandoned."

The editorial further stated that, since more and more land is consumed by industrial and population growth, "the time has come to set a program for multiple uses of reservoirs and their watersheds within a general framework such as this:

"1. Control of public water facilities owned by a local community must remain within the control of that community. If a city or town wants to open its public water supply and shed to fisherman or hunters, the decision should rest with that community alone.

"2. Multiple use of water supply systems owned by private firms but servicing the public of one or more communities ought to be guided by the sentiment of the communities using the water as determined by the company which owns the reservoir and its shed.

"3. Water supply facilities held by the state now or to be developed by the state or a state agency may be used for other purposes than water storage as the General Assembly shall direct."

In conclusion, the editorial commented that any program should be so written that the water consumer would have the ultimate veto concerning the use of his water supply for recreational purposes. In addition, the papers noted that adequate safeguards must be written into any provisions allowing for the multiple use of water supplies.

Hopkins Evaluates Baltimore's Water

Edward S. Hopkins, Consulting Sanitary Engineer, of Baltimore, Maryland, has completed the evaluation of the Delaware City Water Company and, upon purchase of that company by the City of Baltimore, will prepare plans and specifications for the rehabilitation of the system.

Utah Confronted With Less Safe Water

According to a report recently issued by the Utah State Health Department, the state's public water supplies are becoming less safe and the number of communities having improper treatment facilities is increasing. The report stated that 59 per cent of the state's public water systems in 1957 had received "approved" or "provisionally approved" ratings. However, only 40 per cent had received a passing grade in the 1959 survey which was made public at this time.

Of 335 supply systems evaluated by the Department, 24 were approved, 111 were conditionally approved and 200 were not approved. Almost two out of every three public water supplies presently fail to meet the State's standards for treatment or have recorded unsafe levels of bacteriological contamination but are planning improvements.

"Partially Oriented" examines the necessity of being . . .

Passed by Degrees

■ A GENTLEMAN of unusual perspicacity has written to me for my opinion about examinations. What are examinations for, he asks, why are they undergone, and what is their relevant importance to the profession.

If this gentleman did not assure me that he was my friend, I would have throught he was someone wanting to get me into trouble. Making off-the-cuff remarks about serious matters like examinations could cause my colleagues to give me some unfavourable attention. Instead of giving views, therefore, I will give facts—facts about the wounds and scars I bear from past examinations.

As an examinee I suffered from the handicap of being unable to pass examinations without working. There were sundry duffers in my class at school and college (duffers with a ball or girls, I mean) who could pass examinations without so much as opening a single sweat pore. They never read a textbook after teatime; they never misread an examination question; they were wilfully incapable of illustrating an answer with a sketch; they never even attempted to sharpen a pencil; and their handwriting was at all times indecipherable. Yet they passed all examinations first go.

My own work was tidy, properly headed and dated, written legibly, given the correct widths of margin throughout, illustrated profusely and in detail, and nearly always wrong. I was one of those who, however many times he had been caught before, was always caught again by the catch question. The simpler the question, the more concisely I was floored by it; the more severe the question, the less I was aware of the fact that my fluent answer was nearly, but not quite, a relevant reply. In consequence I joined that mob of disgruntled outsiders who acquired a permanent belief that examiners held personal ill-will towards us.

Having grown up in an atmosphere like that, it is not possible for me to give more than a biased personal view of examinations. Indeed, I have strayed so far from the ethics of my profession that my primary motive for passing examinations has been the desire "to get on". I was never sure what "getting on" really meant; I am not sure I'm sure today. But it was an impressive phrase when used by persons in authority to persons in bondage like myself, so I did what was suggested. I passed some exams and tried to get on.

In retrospect the process was not as simple as that. I did not, for instance, fore-estimate the monetary cost involved; I never counted the effect on my love life and my resulting marriage; nor did I realize that (just like marriage) passing examinations changes a fellow biologically, physically, mentally and chemically—once and for all, for better or for worse.

For instance there is a bald patch on my left leg which makes it impossible for me to feel comfortable in open society in short tennis socks and shorts, if I should ever feel able to play tennis again. I got that bald patch at the time I was trying to memorise the expansion of the binomial theorem and distinguish it from the expansion for $\log_e (1+x)$. I came in from tennis and sat down at my desk reading and memorising and I found a pair of nail scissors my mother had left around, so I began cutting the hairs off my leg absentmindedly, one by one, as I got the formulae right. Ten months later I discovered that part of my leg was still bare, as it is today—see?

And here is a hole in the back of my hand—see that? Well that came from the second three-hour paper on Pure Mathematics. The "Pure" was to have been "right up my street", as they say, because I had failed it at intermediate level, so I concentrated hard on it and got it going well (thus eventually failing in "Applied" which I neglected because I thought I was good at it). Well, there I was in this examination room, and there in front of me was this confoundedly simple infinite series to summate—if only I could find out just how. Do you think I could? I twiddled a pencil round and round on the back of my hand and made an interesting hole in it, while my brain worked feverishly. Ten months later I discovered the hole still hadn't filled up, as it hasn't to this day—see?

And then there is also the question of my digestion. Before I went in for passing examinations I could eat a cubic foot of fish and chips, follow with a dozen pancakes, top up with thick creamy coffee and finish off with four or five doughnuts and not feel a thing. Now, if anyone asks me how many cusecs there are in five million gallons a day I have to take a dyspepsia pill before I can be certain of getting an answer without going to hospital after.

In the matter of personal behavior, too, I seem to have been affected. Lots of my friends (and all of my enemies) now say they dislike it, especially when they ask me a question. They say they object to lunacy on serious matters, and do not understand why I should squint and sneer at them while I am trying to think up an answer. But this behaviour simply comes from the hours I spent standing in front of my desk trying to memorise the contents of my notebooks. I would walk round the room reciting, stop at the desk and raise one aching foot in the hand, and peer at my notebook with half-closed, half-open, eyes. I had to have my eyes half open in order to see whether I had cited my lines correctly; but equally, I had to have them half closed lest I should perceive the next set of lines I was about to try and recall with my own unaided memory. I cannot help it if these postures have stayed with me since.

Biologically I survived the impact of examinations—at least there is evidence to support the view. Financially, I was able to write off my debts in the next eight to ten years, and I got about twenty per cent back on the

CONTINUED ON PAGE 103A

Differentials recorded by water flow indicating devices can be recorded or put to work by a . . .

Linear Output Flow Meter

by WM. BRUCE MURRAY, Civil Engineering Assoc., Water Dept., Long Beach, Calif.

EDITOR'S NOTE: This article describes a device for indicating water flow by direct readings. The device produces an electrical output directly proportional to incoming raw water flow to a water treatment plant, therefore, besides indicating flow, it can also pulse chemical injection equipment, totalizers, etc.

Much of the detail has not been presented because of space limitations. If additional information is desired by the reader, the editors suggest he write the author directly.

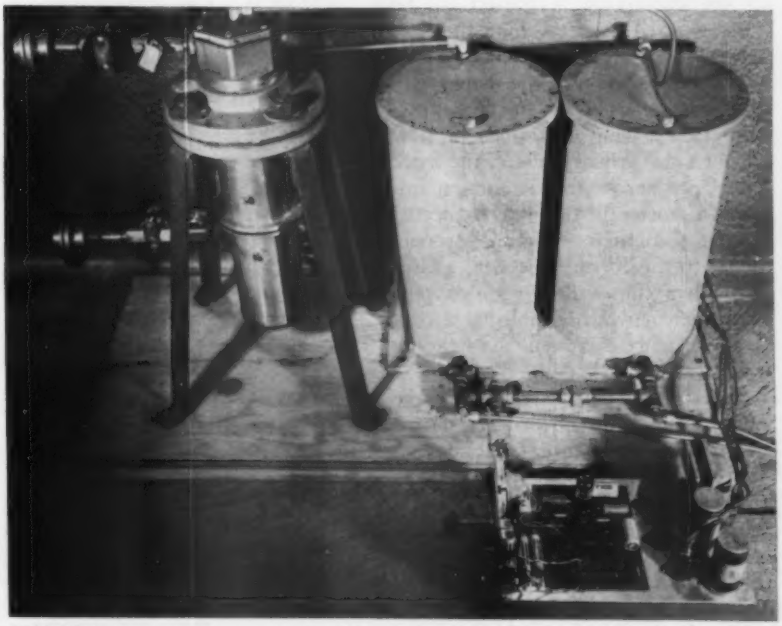
■ A DIFFERENTIAL EXTRACTING FLOW METER, of the type to be described, is indicating flow of raw water entering the Long Beach Water Treatment Plant, Long Beach, Calif. The unit is connected across a 42 inch orifice plate on the raw water inlet line to the plant and besides indicating flow, it is also controlling the feed rate of copper sulfate and chlorine to the raw water.

The designed purpose of this flow indicating device is to meter a differential producing device such as a Venturi tube, orifice plate or flow nozzle and produce an electrical output which is directly proportional to the velocity of the incoming raw water flow. The flow indicating device will:

1. Sense and extract the non-linearity of a differential producing meter in one operation.
2. Detect differential equivalent to 150 inches of mercury within an accuracy of 2 inches of water without range adjustment.
3. Minimize differential surging.
4. Provide instantaneous readings from maximum to minimum scale.
5. Provide an electrical output which can be indicated, recorded and totalized.
6. Maintain an accurate output unaffected by ambient or process temperature changes.

General Description

The flow indicating device essentially consists of a diaphragm which is subject to a force unbalance created by the pressure differential exerted on each face of the diaphragm from the high and low pressure taps of a differential meter. Opposing this force unbalance is a continuously oscillating wire (Figure 2) of a certain designated length, one end of which is fastened to the axis of the diaphragm, normal to its surface, and the other end of which is fastened to a fixed support. A similar wire separate from that attached to the diaphragm but subject to the same environment, is also in continuous oscillation, the frequency of which is made to electrically oppose



DEVICE being used to monitor primary meter on raw water inlet at the Long Beach Water Treatment Plant. The unit indicates changes in flow and produces a linear output to control the rate of copper sulfate and chlorine injection proportional to the flow.

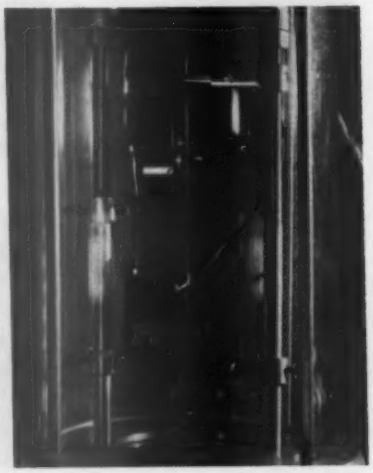
that of the diaphragm-attached wire. This second wire is externally loaded with a variable length adjustment so that its frequency can be made identical to the diaphragm-connected wire at no-flow or static pressure conditions. A pressure differential across the diaphragm sponsored by the flow of raw water into the water treatment plant through the primary metering element increases the tension in the diaphragm-connected wire in the device which increases its frequency of oscillation. The resolved difference between the two wire frequencies is a direct measurement of the raw water flow (velocity). The externally loaded wire establishes an initial operating condition which eliminates the necessity of an external bridge and also provides a means of temperature stabilizing the system.

Sensing Element

The device, illustrated at the bottom left of Figure 3, senses the differential produced by the primary metering element and converts this differential to a mechanical movement represented by the vibration of a wire. Essentially this unit is composed of two receiving reservoirs and a pressure extracting chamber which consists of a flanged cylinder separated into two compartments by a neoprene diaphragm. The upper side of the diaphragm is subject to the force exerted from the high pressure tap of the primary metering element and the lower side of the diaphragm, the force exerted by the low pressure tap. During conditions of flow through the primary meter, the force unbalance across the diaphragm imparts a tension in the wire connected to the diaphragm which is proportional to the force. This wire passes through a thin-walled modified pipe arrangement which establishes a constant distance between the take-up winch and a point intersecting the perimeter and the center line of the pulley. The winch provides a means of initial diaphragm adjustment in which the tension in the wire is equivalent to the mass of the lead weight at no flow or zero differential when the diaphragm is distended. The wire leading from the low pressure chamber which is not connected to the diaphragm, is a reference wire that is subject only to a force provided by the mass of weight hanging from its free end resulting in a fixed wire tension between the vertical axis of the pulley and the micrometer screw. The two electromagnet-electromagnetic pickup supports, besides positioning the wires, contain the electronic components which together with other related equipment provide a means of starting and keeping the wires in vibration. Note that the physical characteristics of the high and low pressure chambers are identical except for the difference in volume and the length adjustment of the reference wire. Once the calibration of the diaphragm-connected wire is completed (initial adjustment at zero differential), the micrometer screw is turned either in or out until a position is obtained with the reference wire in which its frequency of oscillation is exactly equal to the diaphragm-connected wire.

The high and low pressure reservoirs are located intermediate between the pressure extracting unit and the primary meter. It is the purpose of these units to resolve the liquid pressure of the primary meter taps to a gaseous state in order to prevent dampening of the wires and other related equipment. During a condition of operation, the liquid or water will rise in the high and low pressure chambers to an elevation in which the pressure of the compressed nitrogen* will equal the pressure of the applied fluid.

Standard plumbing parts are used throughout the construction of the sensing element. The pressure extracting unit must be made of high grade brass, particularly the electromagnet-electromagnetic pickup supports. Placement of the electromagnet and the electromagnetic pickup must be as indicated in Figure 3 with approximately 2.5 inches O. C. separating each unit. The pulleys must be machined to a very close shaft tolerance in order to prevent vibration and dampening at certain operating frequencies. The weights can be made uniform by constructing each to the same dimensions and balancing their mass with lead shot ($\pm$ 4 pounds). The flanges on either side of the neoprene gasket should be of metal-inserted Uscolite because of their light weight and electrical insulation qualities. The pressure reservoirs can be composed of standard pipe; however, special consideration should be given to the wall thickness and the plate size since enormous forces are encountered even at the most moderate pressures.



PRESSURE applied to a diaphragm-connected wire increases the tension on the wire and increases its frequency of oscillation.

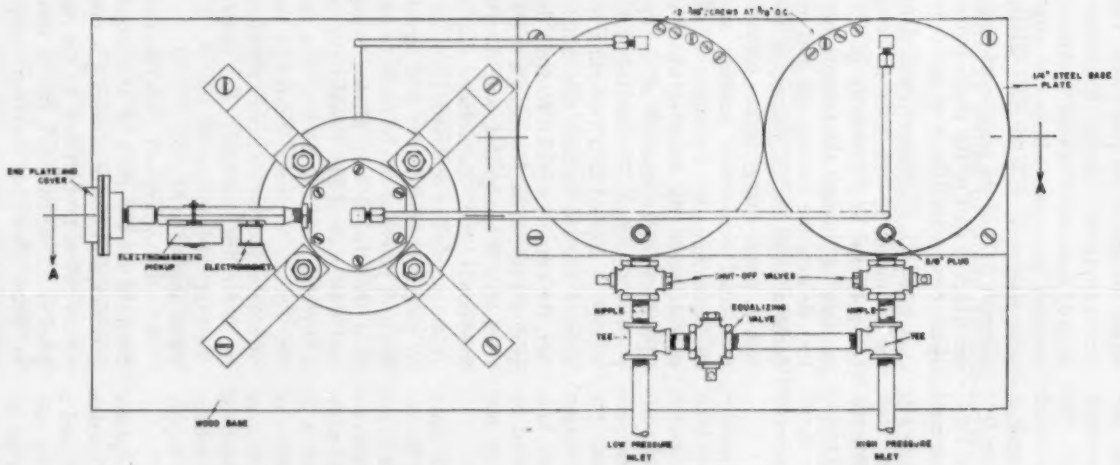
Electrical Detail

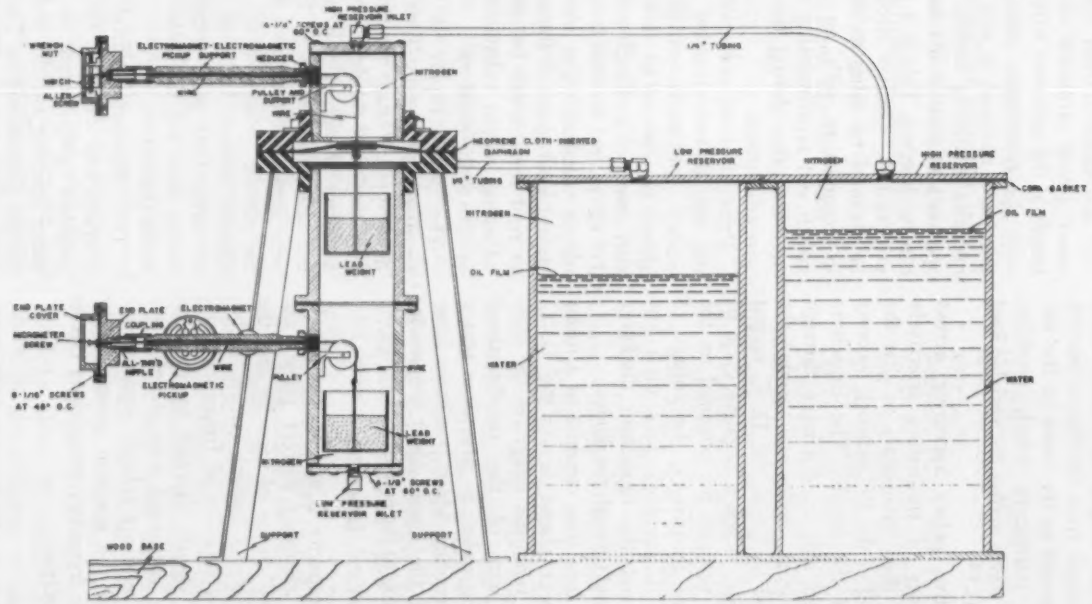
The electrical schematic (not shown) is a diagram of a self-starting, self-oscillating frequency detecting amplifier which converts the differential across the primary water flow meter to an electrical output directly proportional to the velocity of flow.

Each half of the plate load on the tube consists of an electromagnet which is mounted in close proximity to the diaphragm-connected wire or the reference wire on the electromagnet-electromagnetic support. Experimental apparatus is shown in Figure 4. The electromagnetic pickup coils furnish the excitation potential to each of the grids of the tube after passing through a transistorized preamplifier section.

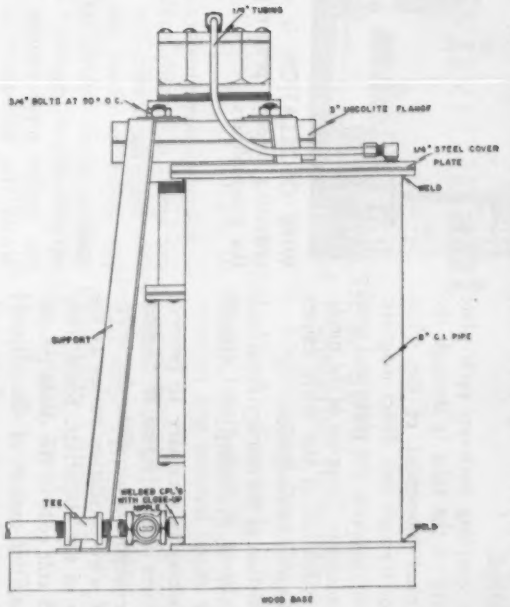
When the power supply is energized, a pulse of plate current flowing through each electromagnet magnetizes the associated plate circuit core and produces a minute deflection of each wire towards the electromagnet. These movements are mechanically transmitted along the axis of the wires which changes the air gap of the electromagnetic pickup coils and induces a voltage in each of the preamplifiers and eventually to the grids of the tube. By proper phasing of the preamplifiers, the con-

*Nitrogen gas is inert and non-corrosive to metallic, rubber and plastic parts. Its most important feature is that it will not combine or enter in solution with water.





SECTION A-A



THREE DIMENSION view and section of differential extracting flow device.

ditions of self-sustaining oscillations are fulfilled.

The coupling between each plate and grid of the tube is through the mechanical movement of the wires and not through any direct magnetic coupling between the plate and grid electromagnets. Stopping of the mechanical vibration of the wires causes the tube to cease oscillation.

A portion of the energy from each plate circuit is limited and clipped by the diode sections and resistors. This action is necessary to produce a uniform output signal throughout the frequency range since the intensity of wire oscillation varies as the square of the amplitude. Since there are 1.5 volt cells in the diode ground returns, the output of the clippers cannot exceed 3 volts peak to peak over wide ranges of signal input. Each output from the clipper section is connected to the bases of the unbiased transistors which produces square waves across the variable load resistors.**

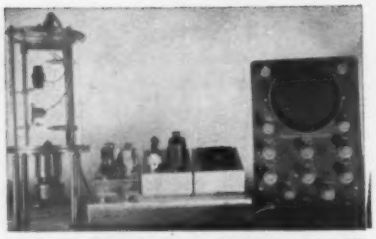
Positive pulses appearing across the bases of transistors effectively cut off these transistors so that the potential of the RC network becomes that of the supply. The capacitors are then able to discharge through the resistors, diodes and through the modified bridge to the D. C. output terminals. When a negative cycle of signals reverses the potential on the bases of transistors, the voltage of the R. C. network falls to a low value and the capacitors discharge to ground through the diodes.

The long time constant of a meter movement placed across the D. C. output terminals integrates the algebraic sum of the uni-directional charging pulses to provide a steady meter reading which is a linear function of the input signal frequencies according to the equation:

$$i_M = FCE_o$$

Since capacity **C** and E_o (amplitude of the charging current pulse) are fixed by choice of capacity and the action of the limiting circuit, i_m becomes a function of frequency only.

The signals supplied by the diaphragm connected wire and the reference wire are entirely separate except for the common power supply and the frequency comparison circuit of the output.



WIRE OSCILLATION is made self-sustaining through proper phasing of the preamplifiers.

A loudspeaker provides a convenient means of initially calibrating the flow metering device. The audio output switch is closed on the loudspeaker circuit which cuts out the variable output resistance and forces the square wave signals to appear across the secondary of the plate transformer. With the sensing device disconnected from the primary meter (input terminals closed), the length of the reference wire is varied with the micrometer screw until a position is obtained in which the frequencies appearing across the loudspeaker are identical and no beat note can be detected. This is a rough approximation. Greater accuracy can be obtained by using an oscilloscope in conjunction with an electronic switch and superimposing one signal over the other during the reference wire adjustment.

Prior to actual operation (assuming the above correction has been made), the audio-output switch should be returned to its initial position (output) and a 50 microampere D. C. meter connected across the output terminals. The meter output should read zero. If the meter fails to read zero, it can be corrected by adjusting output resistances on one or both of the resistors.

The power supply is full wave rectified and heavily filtered to reduce ripple. Voltage regulation is not necessary since the device can tolerate a voltage change of ±50 volts without changing frequency. Since it is very important that both sections of the circuit be stabilized, a voltage divider arrangement was employed to furnish the plate supply voltage to the tube and the collector supply to the transistors.

The electronic control amplifier contains four controls: two function switches (audio-output switch and a range selecting switch) and two calibration potentiometers. The range selecting switch, when used in conjunction with the calibration potentiometers, provides full scale meter deflection at any of the three positions (0—10, 0—100 and 0—1000).

Rate or Totalizing Control

In addition to an instantaneous or indicated value of frequency (or velocity), another circuit can be added to provide a means of obtaining a rate output directly proportional to the strength of the applied D. C. signal.

The basic element is an electromagnet which consists of a coil wound around an iron pole piece. A steady A. C. voltage (6.3 volts from the filament supply) is impressed on the coil and the resultant alternating current in the electromagnet coil produces an alternating magnetic field across the gap of the pole piece. The electromagnet (being horseshoe-shaped) is mounted against the microammeter case and induces the magnetic field (A. C.) on the steady magnetic field of the permanent magnet which is part of the meter movement.

A small D. C. current applied to the terminals of the microammeter (proportional to the velocity of water flowing through the primary meter) deflects the moving coil and induces a small A. C. voltage in the coil. A phase change occurs between the initial zero-center position and the maximum coil movement of 50 microamperes, the value of which is equivalent to the strength of the applied D. C. signal. The induced A. C. voltage is applied to a two-stage resistance coupled vacuum tube amplifier, the output of which controls the grid of a thyratron. Normally a thyratron, once it has ignited, will operate indefinitely until the voltage source (plate supply) is removed. However, by proper phasing at the grid signal, the grid potential can be made to exceed the critical bias at any point and thus control the conductivity of a thyratron for any portion of a cycle. The D. C. motor located in the cathode of the thyratron can therefore be controlled smoothly by simply changing the phase of the A. C. signal applied to its grid.

A cam-operated microswitch mounted on the shaft of the motor provides a means of obtaining a rate measurement proportional to the applied D. C. signal which can be used to pulse chemical injection equipment, totalizers, etc.

**Minor, W. H., *The Transistor in Simple Circuits*, Radio and Television News, 1952.

Radical new techniques may be required to keep up and cope with . . .

Our Changing Environment

We would like to call your attention to the editorial on page 292 that was prompted by the discussion presented here. We feel that it will provide some background for a more thorough analysis of the responsibilities of all water works people.

The Editors

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EDITOR'S NOTE: Past progress in public health must be recognized as getting us where we are today. Industrial research is creating new, different and unusual problems which add to the complex of population growth and its allied problems. Relatively new contaminants in the air and on the ground will no doubt require new techniques. The warning is sounded here, together with some PHS programs now in operation.

■ THE CONCEPT OF compressing time and viewing the human species as a few weeks old sharply outlines human progress. If we assume an interstellar reporter from a superior civilization whose days equaled about 1,000 of our years, and assume further that they discovered the earth at about 5,000 B.C., then, to paraphase Ralph V. Smith (1), here is how the report might read:

> Seven days ago we first reported that there was life on a planet in a minor solar system. The more intelligent denizens inhabited caves, hunted others for food, used stone tools, and knew the lever principle. For two days there was no change. On the third day, our observers reported that the inhabitants had learned to build with lumber and rock, and had begun to use lesser denizens to supply power. On the fourth day, wheels and bronze tools came into use. On the fifth day iron tools were in use and canals and reservoirs were seen. Late that day the alphabet was invented.
>
> On the sixth day, geometry, screw and pulley, the stone arch, and coal were in use. Yesterday, algebra, trigonometry, and the compass became available. Magnetism and chemistry were being investigated.
>
> Today, the eighth day of our observations, progress is accelerating. At about midnight, the printing press was invented and a new land mass was discovered. At 6:00 a.m., the similarity of electricity and lightning was noted. At 7:00 a.m., steam was first used for power. By 8:00 a.m., the relation between electricity and magnetism was established, and the electric motor came into use. Between 9:00 and 10:00 a.m., the typewriter and linotype were devised; a new furnace came into use, and aluminum became available; the light bulb was devised, and electric generating plants were built; the telegraph and telephone became available, and soon thereafter radio.
>
> Between 10:00 and 11:00 a.m. airplanes, motion pictures, radio and television broadcasts, the theory of relativity, and nuclear power came into being. Stand by for further developments.

Now, in this recital of human progress, no mention is made of food preservation, population increase and concentration, the automobile, water use and abuse, nor of man's problems with his environment.

We are in the "eighth day of change" in our environment. Figuratively, the field of public health came into being at 10:00 a.m. The pace is not slow. The change in environmental hazards from epidemics of disease to the finite closing-in of our environment is subtle. Today, we deal increasingly with nonliving contaminants in water and air, and with radiological health problems.

Past achievements in public health have been many. For example, typhoid fever and dysentery are waterborne diseases. Much of the nation's infant mortality rate stemmed from such waterborne diseases, and from raw milk and other unsanitary environmental conditions. Yet infant mortality has been sharply reduced from 100 per 1,000 live births in 1915 to about 25 today. A major share in the conquest of the communicable diseases can be assigned

to the application of sanitary engineering practices in water supply and water pollution control, milk and food sanitation, insect and rodent control, industrial hygiene, and related fields.

In an ever-changing environment new problems must be anticipated and attacked before *finis* is written to the old. We are facing problems of increasing complexity in the change from an agricultural to an industrial economy, from a rural to an urban people, from a young to an older population, all concomitant with an explosive increase in population and production and an unprecedented acceleration in technology.

Today, we produce three times as much in a 40-hour week as we did 100 years ago in a 70-hour week. Projecting this increase in production to the year 2000, we should be able to produce in a 7-hour day what we now produce in a 40-hour week.

The accelerated rate of production has included the rise of completely new industries. Among those not mentioned by the intersteller reporter are plastics and rocketry. Most of this industrial production adds to our comfort and well-being. On the reverse side of the coin, such production adds problems of waste disposal and pollution that threaten our health through contamination of the environment.

The problems of water supply and water pollution control continue to present a constellation of complexity. For example, some 400-500 new chemical compounds are introduced annually to the market. Thus, pesticides have contributed to the control of vectorborne diseases such as malaria, typhoid, trachoma and dysentery. The Public Health Service, U. S. Department of Health, Education and Welfare, estimates that 5 million lives have been saved in this country since 1942 through the use of insecticides. At the same time, these pesticides and insecticides are helping to increase food production by making the land produce more and reducing crop losses. However, pesticides are adding to the problems of our changing environment, even while they are helping us conserve human life and providing more food.

There is the possibility that many of these substances, including insecticides, fungicides and weedicides, can reach the food-consuming public by leaching into ground water or running off in streams used as drinking water supply sources.

Similarly, the development of new industries—electronics, plastics and missilery are representative—involves new manufacturing processes and even the use and creation of new chemical substances. These conditions have drastically changed the nature of waste products which enter the nation's streams. The wastes of earlier times were bacterial and biologic in nature and susceptible to known waste treatment processes. Those of today are non-bacterial and chemical. Many of these organic, synthetic wastes are complex, defying separation and analysis. They are generally not subject to inactivation (as by disinfection or heat). They are predominantly man-made. Most important, they are generally cumulative. This latter observation suggests that, though nontoxic in trace amounts at present, their cumulative effect over time must be considered. When placed against the realization that water purification processes are designed primarily to control biological contaminants, the need to consider more intensively and extensively the effects of chemical contamination becomes pressing and urgent.

As the population increases and industry expands, the need for water rises. Forty billion gallons of water a day was used in 1900. Today we use 270 billion gallons per day. In 1980, an estimated 600 billion gallons per day will be needed.

The increased use of washing machines for clothes and dishes, air conditioning, and other modern appliances is raising the amount of domestic water consumption. The industrial production necessary to keep pace with the demand of a growing population for domestic appliances and the newer industries is likewise raising the amount of water consumption.

Research designed to increase the amount of water available through desalting processes, the prevention of evaporation, and cloud-seeding are all possibilities; but the treatment and re-use of waste water is given major emphasis. It is, however, increasingly difficult to control water pollution, not merely because of increased population, detergents, and the new complex wastes, but also because waste treatment facilities construction has fallen behind. The construction grant program of the Public Health Service is designed to help meet the needs in this area.

A first major blueprint of the nation's polluted streams is emerging through the National Water Quality Network which was instituted a few years ago by the Public Health Service. Organized, maintained, operated and financed jointly by the Federal Government and state and local agencies, approximately 60 sampling stations of an anticipated total of 250 have been established at a number of water courses for the examination of radioactivity, plankton and coliform organisms, organic chemicals, and for carrying on a number of biochemical, chemical and physical measurements. Local laboratories are performing conventional chemical analyses. The more complex examinations are made by the Public Health Service. The Service is also making all results available to collaborating agencies and other interested groups.

The publication of the first year's data gathering operation has recently become available. A companion volume of analysis and summarization is in press and will be out early in 1960, together with the compilation of the second year's data. The plan is to issue annual documents within three months following the "water year"; namely, every January-March.

Concurrent with such an inventory water research revolves about such questions as the following: having identified a new waste, can its pollutional effects be predicted? In disposing of waste effluents, is effective use made of the receiving water? Can polluted water be effectively treated for re-use? Studies underway or under consideration in various governmental and university laboratories include the use of stabilization ponds, investigation of bio-oxidation surfaces, the treatment of sewage by anaerobic contact, the role of water in the transmission of viral diseases, and the role and functions of algae and fungi.

Water is not the only problem either created or intensified by the changing environment. Air pollution once a simple matter of smoke abatement, is now complicated by automobile exhaust fumes, combustion

from a new variety of industrial processes, and the "lid" that air inversion can put on these noxious fumes. When the photo-chemical reactions of sunlight with these air contaminants take place, we have a modern problem, acute air pollution.

Our environment is reminding us that the air and water resources are finite in their ability to absorb, disseminate and render innocuous the waste products from our modern technological society.

Thousands of communities in the United States have air pollution problems in varying degrees, involving deterioration of paint and rubber, blighted crops and livestock, reduced visibility that causes accidents, and eye irritation.

The economic losses from air pollution in the United States alone are estimated to be between $2 and $4 billion annually. Of even greater concern, however, is suspected chronic health impairment. This is not subject to easy measurement, and is not established. Are individual air pollutants harmful to humans? Are certain combinations of pollutants harmful? These are questions for which answers ultimately must be found.

Radiological health is another of the most important of the new problems. It has been estimated that in about 20 years, one-third of newly-installed electrical power will be generated at nuclear plants. The use of radioisotopes in sanitary engineering, medical, industrial, agricultural and other scientific research is continually increasing. Radioisotopes are being used as tracers, arc initiators, fluid interface indicators, and thickness gages.

Sanitary engineers are using radioisotopes to study the role of algae in the natural cycle of waste recovery in streams; to study corrosion; to determine the capability of slimes to adapt to and cope with certain organic wastes; to treat sewage; and to make more complete chemical assays of water through activation analysis.

The crux of this host of new problems we face lies in the long-range physiological effects on people of these new subtle and insidious contaminants in our water and air. A stepped-up research tempo is necessary to provide new principles of environmental control.

The sanitary engineer must apply himself diligently to the solution of these problems. Other specialists in the public health fraternity have important contributions to make. In either case, it is the sanitary engineer who will apply the remedies found. The need for sanitary engineers and the importance and scope of their work are growing constantly. Air pollution and radiological health, the most recent problems of our changing environment, are prime examples of why sanitary engineering skills are needed and are broadening.

The need to master more knowledge in the engineering and basic sciences has led a number of people to believe that a longer period of study is necessary to produce a sanitary engineer. A fifth year of study would be indicated to train a sanitary engineer. This, of course, involves the provision that allied professional personnel also become available.

One of the early English poets said, "No man is an island unto himself." In today's complex world, this is a truism. The interdisciplinary and multidisciplinary approach is an absolute necessity, if we are to get anywhere with present day problems.

A recent survey of 4,000 sanitary engineers (2) revealed that about 40 percent had a Master's Degree or better. Only one percent of the respondents, however, listed air pollution as their primary speciality, and only 0.5 percent listed radiological health.

It thus becomes obvious that trained manpower must be made available if we are to meet the stern demands of an era of rapid environmental change.

As we approach midnight in the time of our figurative intersteller reporter, and try to conquer outer space, we must be prepared to meet the new hazards resulting from our changing environment.

References

(1) Ralph J. Smith, *Engineering as a Career*, 1956
(2) *Sanitary Engineering Manpower*, PHS Pub. No. 703, 1959

Engineers and Proprietary Rights

An engineer generally is expected to determine for himself what information gained on one job may be utilized on a subsequent job, while he keeps in mind that he or his new employer may later be held legally accountable. According to a survey made by the Employment Conditions Committee of Engineers Joint Council, entitled "A Survey of Employer Practices and Expectations Concerning the Safeguarding of Proprietary Rights," the Committee's report presents the result of a questionnaire submitted to 800 major industrial companies which employ engineers.

The response indicate that wide use is made of employment agreements which protect the current employer, but that only in rare instances are previous employee agreements investigated. "These former agreements, however, can and have formed the basis for legal actions with both the engineer and new employer as defendents," the report pointed out.

Almost one-half of the employers responding disclosed that they use employee agreements to cover patent assignments, and non-disclosure of proprietary information. Due to the difficulty in defining what constitutes trade secrets, and confidential company information, inquiry was made to determine what type of instruction employees are given. About half of the employers feel their areas of confidential information are generally defined. Only 20 percent give specific descriptions to new employees, and less than five percent explicitly cover in termination interviews what is considered confidential information.

As in the case of the new employee, comments indicate a general attitude that reliance is placed almost solely on the terminating employee to distinguish between proprietary and general information.

Single copies of the Report may be obtained free from Engineers Joint Council; cost of bulk quantities are available on request.

Suspended Solids Publication Available

A recent publication entitled, "Physical and Chemical Behavior of Suspended Solids", has been made available, free of charge, by the Mellon Institute, 4400 Fifth Ave., Pittsburgh 13, Pa. The author of this booklet is Richard D. Hoak, a member of the Institute.

Requests for copies should be directed to the Institute.

RESEARCH PROGRESS REPORT

Investigation shows corrosion and red water stop where . . .

Calcite Coating Protects Water Pipes

The time for a more rapid adoption of new ideas and treatment processes is now. Please note the editorial on page 292 that points this up, particularly in relation to this Research Report.

By R. F. McCAULEY, Assoc. Prof.
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EDITOR'S NOTE: The results of distribution system corrosion are well known. Theories explaining the cause, together with practical means of controlling corrosion have been advanced from time to time, yet water quality continues to deteriorate in the distribution system. Dr. McCauley describes here a practical means of insulating pipe from attack through careful control of calcium carbonate and polyphosphate content. Field trials are needed to define optimum concentrations required during coating formation and levels which should be carried throughout the system to retain and improve the protection.

■ AFTER 20 YEARS or more of service, unlined cast iron and steel pipes experience increased friction due to internal pipe corrosion. In time, the reduction in carrying capacity may be 60 percent or more.[1] To avoid these large economic losses many waterworks managements now require that new metal pipes be cement or coal tar lined.

Unfortunately, a large part of the capital investment of many distribution systems is in older, unlined cast iron and steel. When friction losses become excessive, the corroded pipe must be replaced or cleaned in place with mechanical equipment.[2] For cleaning, access openings are cut at two sections of a line several hundred feet apart. Hydraulically or mechanically driven equipment is then used to clean out the incrustations which restrict pipe flow and cause excessive friction losses due to roughness of the pipe walls.

Cleaning usually restores most of the pipe capacity for a time. The removal of corrosion products during cleaning almost invariably accelerates the corrosion of newly exposed bare metal and the restored capacity is often lost, sometimes in a few months or less. For this reason, many water utilities have discontinued cleaning of mains unless the pipes can be simultaneously cement or bituminous lined.[3]

Rehabilitation of badly corroded iron and steel mains is usually accomplished by cleaning and cement lining. Cleaning does not represent a large capital outlay; cement lining is far more expensive. One reason for the large cost of cement lining is the labor and time required. During the lining process temporary lines are usually laid to provide customer service. As a result, the cement lining of several thousand feet or more of pipe becomes a sizeable municipal project.

The cost of cleaning and cement lining of water lines is often 40 to 75 percent of the outlay for new mains.[4,5] In congested downtown business districts, cleaning followed by cement or bituminous lining may be the only economic means for restoring adequate water service. For outlying areas, the price differential between lining and pipe replacement may not be great. Regardless, the rehabilitation or replacement of large sections of distribution systems becomes very expensive and many communities with a serious need for these improvements have found it necessary to defer them for indefinite periods of time.

Because corrosion proceeds continuously in most distribution systems, increased friction losses are usually

preceded and accompanied by the plague of "red water" which may at times render a domestic supply unusable for general household purposes. Epidemics of rusty water are common to many water utilities during periods of high demand for lawn irrigation, following the use of fire hydrants or other disturbances in distribution mains.

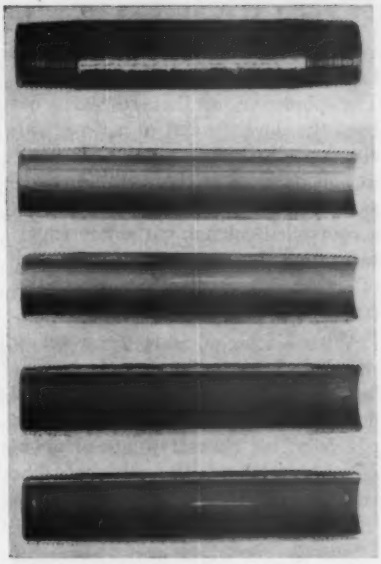
Anti-Corrosion Water Treatment

The previous discussion points out the value of anti-corrosion water treatment processes which permit corroded water mains to be cleaned without the attendant expense of cement lining. Processes which develop protective anticorrosion coatings on the pipe walls throughout a water system are equally useful. An ideal treatment process which accomplishes both of the above ends should satisfy these requirements: (1) the treatment should be a normal and simple part of conventional water treatment, (2) substances added to the water and their reaction products should be non-toxic, (3) the treatment should cause no change in the palatability or industrial quality of the water, (4) no incrustations should be developed which interfere with water meters or with heat transfer in hot water heaters, (5) the treatment should be relatively inexpensive, (6) corrosion of newly bared metal after cleaning of distribution mains should be arrested and (7) throughout the system there should be an alleviation of corrosive conditions which cause "red water" and in time lead to serious impairment of carrying capacity.

Three treatment processes for providing anti-corrosion protection of iron pipes are now used in practice: (1) calcium carbonate ($CaCO_3$) or egg shell depositions, (2) the addition of between 1 and 4 mg/liter of sodium polyphosphate and (3) the addition of 12 to 16 mg/liter or less of sodium silicate. Each of these protective practices has had wide use, but none has proved uniformly successful for permanently arresting water main corrosion.

Research Program

Because of the serious need for better and more reliable anti-corrosion treatment procedures the author has undertaken research which has previously been reported in several publications.[6,7,8] To date, all work has been with protective calcium carbonate (calcite) coatings. A better and more complete understanding of several important factors which govern these depositions has resulted. In addition, a simple, inexpensive and practical 2 hour field procedure for laying down hard protective calcite coatings has been developed.

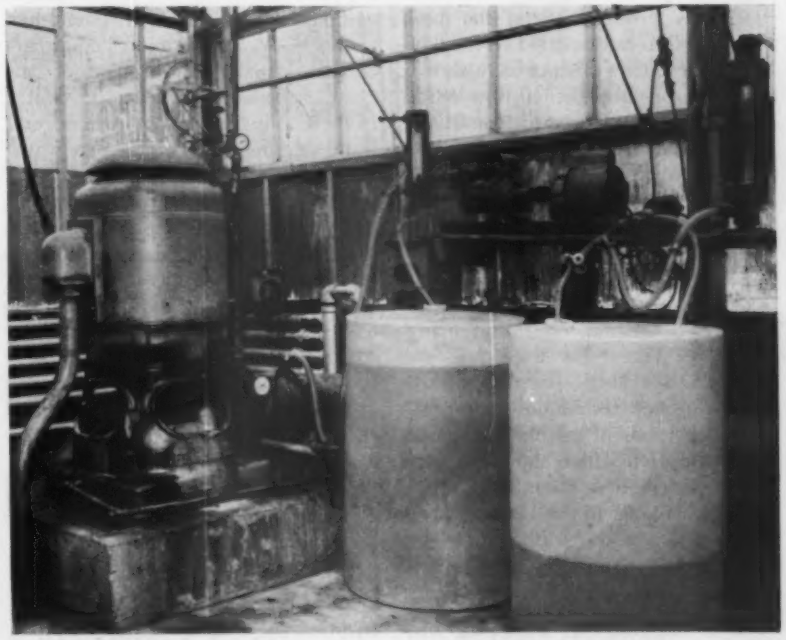


IRON PIPE NIPPLES cut to show interior walls. Pair in center show bare metal surface after sandblasting, while pair at bottom were sandblasted and coated. Translucent calcite coating was formed in two hours.

Results from Preliminary Investigations

Initial experiments of this work were designed to establish test conditions which were similar to those which might exist in newly cleaned water distribution mains or in systems which had experienced long histories of corrosion. Experiments with both tap and synthetic waters soon showed that calcium carbonate scales were not easily laid down in water distribution systems. It was also discovered that newly bared metal (represented by sandblasted cast iron specimens) corroded more rapidly than had been anticipated. In "unsaturated" Michigan State well water, containing about 6 mg/liter of dissolved oxygen, the specimens rusted badly within 12 hours under static (zero flow) conditions. With a flow velocity of 0.5 feet per second the rusting was not so apparent. Checks on weight loss of metal showed that the absence of heavy rust deposits under conditions of the above and slightly higher flow rates was primarily due to a continued removal of corrosion products. That is, corrosion of the initial bare metal was not greatly affected by velocity at relatively low rates of flow.

A series of studies was next initiated using waters with $CaCO_3$ concentrations above the saturation level. With various $CaCO_3$ supersatura-



WELL HOUSE during field experiments on Michigan State University campus. Shown are 350 gpm well, chemical solution tanks, pumps and rotameters.

tions, mixed coatings of iron oxide, iron carbonate and calcium carbonate did result. Flow velocities of 2 feet per second or higher were required in all cases to develop these iron-calcite deposits. Soft iron oxide which provided no apparent anti-corrosion protection developed on the metal during all static tests.

Limitations on the Development of Egg Shell Coatings

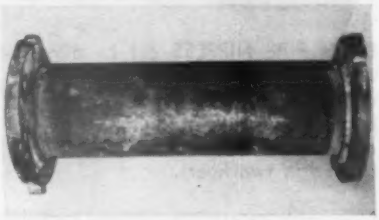
As a result of these experiences it has been concluded that the conventional adjustment of a water to a positive saturation or Langelier index[9] is not a procedure which in itself assures that corrosion will be arrested. This author is now of the belief that protective calcium carbonate coating cannot develop on corroding iron until the very high initial corrosion rate is reduced. Moreover, the presence of flocculent iron oxide or other soft depositions inhibits the development of protective coatings, even in the presence of calcium carbonate supersaturations. For static or low flow conditions it appears that satisfactory protective deposits will not be developed, regardless of the $CaCO_3$ supersaturation. With flow velocities of 2 feet per second or higher a relatively hard, but porous protective coating may result.

Most water distribution systems experience static or very low flow conditions during much of the midnight to six o'clock period of the day. While these experiments have shown that the soft deposits of iron oxide which develop under static conditions inhibit calcite coatings, a positive saturation index may eventually result in protective iron-calcite deposits if high velocities are experienced at regular intervals. For dead ends and low flows it seems doubtful that conventional levels of $CaCO_3$ supersaturation will be helpful, even after many months or years. For these reasons, attention has been directed toward developing new techniques for formulating the levels of calcium carbonate supersaturation which should be carried in distribution mains and for arresting corrosion in dead end areas.

Work With Large Calcium Carbonate Excesses

As a step toward developing improved techniques some eighty experiments have been made with large calcium carbonate supersaturations. Flow velocities for these experiments have been 2 feet per second or higher. The objective of this research has been the development of a dense calcite deposit which is capable of arresting all or most of the metallic corrosion. With this type of base deposit a controlled calcium carbonate supersaturation should result in the growth of an almost pure calcite protective coating.

With Michigan State tap water, it was found that within 2 hours a very hard, dense coating could be laid down on bare metal by adjusting the pH from it's normal range of about 7.2 to a value of 9.0 or higher. The very large calcium carbonate excess



SECTION OF 6 IN. CAST IRON PIPE, two feet long, used in field coating experiment.

and high flow velocity stifled rusting and permitted development of very useful anti-corrosion coatings.

During these experiments, the piping and tubes of the experimental equipment were filled with sand-like grains of orange colored calcium carbonate. Usually, the amount of calcium carbonate lost from the water in these loose precipitates was several times that deposited on the pipe walls. It was therefore concluded that some further control of the coating process was necessary for any practical development of protective depositions. For this control, experimental work was then begun by the addition of various concentrations of a polyphosphate commonly used by many water utilities.

Control of Calcite Depositions with Polyphosphate

A laboratory procedure has now been developed for Michigan State University tap water which provides positive assurance for the development of excellent protective coatings. In brief, the coating process requires the addition of about 0.5 mg/liter of phosphate (as PO_4) and a calcium carbonate excess, expressed in terms of a "Driving Force Index", of about 100. Computation of the "Driving Force Index" or DFI is straightforward and poses no problem other than becoming acquainted with the mechanics involved in the various steps of its determination.

This level of calcium carbonate excess and metaphosphate concentration, together with a flow velocity of 4 to 6 feet per second, has invariably resulted in hard, translucent protective calcite coatings from Michigan State tap water. Storage of coated samples in oxygen saturated water for long periods of time has showed the coating to have unusual anti-corrosion qualities. If stored in a water which is saturated with calcium carbonate the coating has improved with time.

The coating which is developed by these procedures is quite different from that associated with so-called egg shell deposits. Viewed under the microscope at 100X magnification the deposit is observed to be a translucent, glass-like material. For sandblasted cast iron samples the treated sample is identical in color to the metal previous to treatment. Close observation through the microscope reveals that the initial, untarnished metal shows quite clearly through the calcite coating.

In one test, coated and uncoated specimens were stored for 12 hours in beakers and then compared. The water containing the coated specimens showed no noticeable change. For the untreated specimens, the water was deep red and flocculent iron oxide covered both the specimens and the bottoms of the beakers.

Figure 1 shows two iron nipples which have been cut to show the interior walls. The sections on the left are sandblasted bare metal, the two right hand sections are sandblasted nipples which have been coated by the 2-hour process. The translucent nature of the calcite coating is apparent in this photograph.

Field Experiments

Theoretical computations indicate that this same Driving Force Index, metaphosphate concentration and velocity should develop equally satisfactory coatings on pipes of any diameter. To test the validity of this deduction, a 1200 foot section of 6 inch

cast iron pipe which leads from a campus well to a concrete reservoir was selected for field testing. The well produced a water of the chemical quality of Table 1. Capacity of this pump was 350 gallons per minute, with a resulting pipe velocity of 4 feet per second. The well house piping permitted metaphosphate to be fed at the discharge point from the pump housing into the distribution main. The water was well mixed with the metaphosphate as it travelled through a check valve, elbow and propeller meter.

Sodium hydroxide was fed at the outlet point from the well house to provide the pH adjustment for the required DFI level. Figure 2 is a view of the experimental equipment installed in the well house.

The 2 foot section of sandblasted cast iron pipe, shown in Figures 3 and 4, was dropped in place on the end of the 1200 foot main when the metaphosphate level and DFI were found by chemical analysis to have reached the proper level. Analysis of calcium, alkalinity and pH were made each 10 minutes during the run. Because of the 30 minute refluxing required for metaphosphate determinations only four samples could be checked for phosphate during each experiment.

After several tests to check equipment and to establish the correct chemical feed levels a carefully controlled field experiment was made. DFI and metaphosphate levels for the experiment were at the proper levels of 100 and 0.5 mg/liter respectively. The 2 foot cast iron pipe had been sandblasted inside of each end, then used during several of the initial test runs and finally washed with strong acid. As a result, the metal of the pipe was covered with a brown rust stain but was otherwise clean when the experiment began.

Throughout the experiment, a continued drop of 8 to 12 mg/liter of calcium (as $CaCO_3$) was noted in the 1200 foot main. This drop provided good assurance that calcium carbonate was being continuously deposited. After 2 hours, the pipe section was removed and found to have developed a coating on both sandblasted ends and on a coal tar enamel in the center section. The coating was quite similar to that observed in laboratory experiments when using ¾ inch black iron pipe nipples.

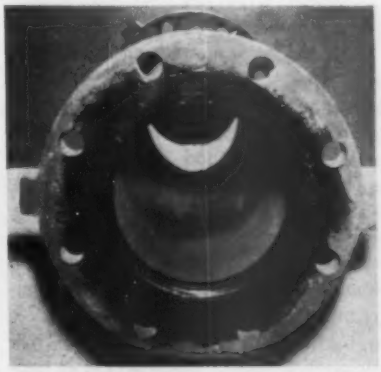
The field-coated pipe has shown excellent anti-corrosion qualities which will undoubtedly improve with time in a water carrying the proper level of calcium carbonate supersaturation. Figure 5 shows the reservoir discharge line in operation with pipe section installed. Additional tests of these field procedures were not carried out during winter months because of a number of local problems which make further work along this line impractical during cold weather. Further testing of the process will be made early in 1960, though there appears no valid reason to doubt that future experiments will be less successful than the initial test. Field tests are also being considered for a number of water systems throughout the nation.

Results

The laboratory and field experiments just described indicate that a useful inexpensive field procedure has been developed for combating water main corrosion. In many ways, the process appears to satisfy many of the criteria previously mentioned for the ideal anti-corrosion water treatment process. However, it is important at this time to view these developments in the light of the present level of field and laboratory experience:

1. The one successful *field* coating of a two foot section of 6-inch pipe was with a water typical of many well sources in southern Michigan. There is every reason to believe that other waters will perform equally well under future testing. The greatest need now is for broad field testing with waters which are low in initial calcium and alkalinity. The criteria which have been mentioned for field treatments are by no means fixed at this time, and must wait on a number of tests with different type waters before being firmly established.

2. Laboratory and field procedures are simple and have been successfully carried out by undergraduate Civil Engineering students with limited training in chemistry. These young men have worked on the project for some time and have become quite familiar with the required techniques. Certain very strict controls are necessary and without these controls the process fails. A reasonably high level of technical competence appears essential to success with the methods described here.



SANDBLASTED interior of 6" cast iron pipe section before field coating experiment.

Field and Laboratory Procedures for Coating Development

For both small scale laboratory testing and full scale field experimentation the technique for coating development has been much the same. The basic principle is the development of a large calcium carbonate excess which is controlled and prevented from precipitating by the addition of about 0.50 mg/liter of polyphosphate. When this chemical adjustment of the water is accompanied by a 4 to 6 foot per second velocity the deposition of a hard, dense coating takes place within 2 hours.

In order to more accurately define the calcium carbonate excess which is required in this work the author has used both the Momentary Excess values of Dye (10), termed ME, and the value designated as Driving Force Index or DFI. The ME value is a statement of the supersaturation of the water and often represents the tendency of the calcium carbonate to be precipitated to the equilibrium level. However, in some waters the concentrations of calcium and carbonate are unequal. For instance, one test water contained 40 mg/liter of calcium and 200 mg/liter of carbonate (expressing both values as calcium carbonate). In this case, the precipitating tendency of the calcium carbonate was best expressed as a Driving Force Index or DFI. The DFI for a given water is the ratio of (the product of the calcium as $CaCo_3$ and the carbonate as $CaCo_3$) to (the product of the calcium and carbonate

at equilibrium). The ME is expressed as mg/liter, while the DFI is a dimensionless ratio. An example of the computations involved in these determinations is given in the appendix.

When a water is high in alkalinity and contains 50 mg/liter or more of calcium (as $CaCo_3$) the ME and DFI may be adjusted to the proper level by the addition of lime, caustic soda or soda ash. Lime is the cheaper and more effective treatment, but increases the calcium hardness. If calcium is low, the concentration may be increased by adding either lime or calcium chloride. Again, lime is preferable. If there is a deficiency in carbonate alkalinity it is necessary to add both lime or calcium chloride plus soda ash.

added far enough upstream from the point of pH adjustment to permit complete mixing. If soda ash, lime, or caustic soda is fed for pH adjustment previous to a complete mixing of the polyphosphate with the pipe flow, a satisfactory coating will not result.

Both the DFI and the polyphosphate concentration appear to be critical. Polyphosphate should be within the range of 0.40 to 0.60 mg/liter, with a value of 0.50 mg/liter appearing optimum. DFI should be about 100. For Michigan State studies, the ME has been 85 mg/liter for best results. A 4 to 6 foot per second pipe velocity seems most desirable, although satisfactory coatings have been developed in the laboratory at lower flow rates.

CAST IRON PIPE SECTION in place for testing at discharge point into reservoir. Coating developed in two hours and showed excellent anti-corrosion qualities.

For developing a 2-hour coating in the field the addition of soda ash and (if necessary) calcium chloride seems best. These chemicals are commonly available at low cost, can be added to water distribution systems without danger and because of their large solubilities are easily fed into the mains. Cost of chemicals for coating 1000 or more feet of pipe is $5.00-$10.00. It is best to use a constant, rather than pulsating type of feed. In experiments at Michigan State University both centrifugal and screw-type pumps have been very satisfactory.

It is essential that both the polyphosphate and calcium chloride be

The process is easily controlled in the field by maintaining a calcium drop of 8 to 10 mg/liter per 1000 feet of pipe. The conventional EDTA method for calcium determination makes this method of control quite simple. It is also well to check the drop in total hardness and alkalinity, for if these determinations are in terms of calcium carbonate, the drop should be identical to that for the calcium.

Continuous checking of pH throughout the 2 hour period is necessary. After 40 minutes to an hour a marked drop in pH level is often noted. This drop is a warning that the rate of calcium loss in the line may have become excessive and the pH and alkalinity should be reduced to the level which maintains the proper rate of calcium loss. Because it may be necessary to change pH and alkalinity levels during a run, the process control is best accomplished by a continued monitoring of the calcium level.

Saturation Excesses for Potable Waters

With ¾ inch pipe nipples it has been observed that coatings deposited during 2 hour treatments are dissolved rather quickly if the pipe is filled with a water which is undersaturated with calcium carbonate. The level of supersaturation which should be routinely maintained in the system cannot now be recommended except on the basis of present practice. Several years of experience in the Lansing, Michigan, water treatment plant, which lime-softens a water similar to Michigan State tap, has resulted in the use of a Momentary Excess or ME of 12 to 14 mg/liter of calcium carbonate.[10] The supersaturation is controlled by a polyphosphate level of 0.25 mg/liter for water when leaving the plant. Riehl has suggested a slightly lower $CaCo_3$ excess with 0.50 mg/liter of polyphosphate.[11] It appears that large calcium carbonate supersaturations can be maintained in the presence of polyphosphate without damage to water meters, house plumbing or hot water heaters. Cost of this treatment varies from $1.00 to $10.00 per million gallons.

There is still a definite need for more information with respect to the optimum $CaCo_3$ excess which should be carried for most effectively overcoming "red water" and other corrosion problems. With the Lansing lime-softened water, rust problems have largely disappeared, even in sections of the system which had previously been problem areas. To test the effectiveness of the Lansing water on newly cleaned iron, two sandblasted ¾ inch black iron nipples were inserted in a feed line of the plant which alternated between zero flow and a velocity of about 6 feet per second. After 6 months service, the nipples had developed a hard, mixed coating of calcium carbonate and iron oxide between 1/8 and 1/16 inch in thickness. While the coatings showed relatively good anti-corrosion qualities,

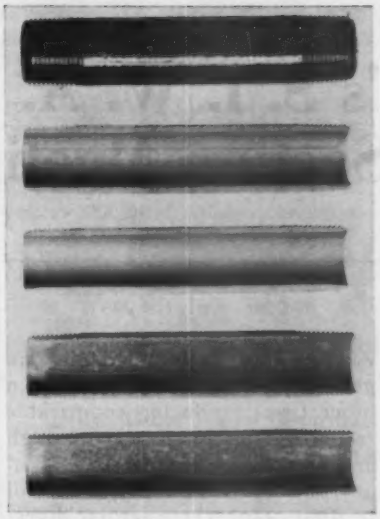
incipient tuberculation was quite evident. Figure 6 shows sections of these sandblasted nipples before and after the 6-month period.

Conclusions

On the basis of a large number of laboratory and one field study with a 6 inch cast iron pipe it has been demonstrated that a satisfactory base cast of calcium carbonate can be developed on iron pipe in 2 hours. By maintaining a phosphate level of 0.25-0.50 mg/liter and Momentary Excess of 12-15 mg/liter of calcium carbonate in the distribution system this coating should improve with time.

Further field testing with a number of waters is essential to further define the optimum levels of polyphosphate, Driving Force Index DFI, and Momentary Excess ME which should be maintained during the 2 hour period. More information is also desirable on the ME and DFI which should be carried in distribution systems to retain and improve the coatings.

For cast iron pipes which have not yet reached a level of deterioration which requires cleaning it seems quite probable that an iron-calcite coating



THREE-QUARTER IN. NIPPLES USED IN LANSING, Michigan. Lime-softened water experiment—center pair shows sand blasted surface—pair at bottom shows results after six months exposure.

can be developed and maintained by carrying a Momentary calcium carbonate Excess of 12-14 mg/liter. Control of this supersaturation requires between ¼ and ½ mg/liter of polyphosphate. Coatings of this type developed from Lansing, Michigan tap water have shown a capacity to reduce corrosion rates but have not arrested tuberculation.

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Clinch River Survey Started

A comprehensive study of the Clinch River, downstream from the Oak Ridge area, has started with eight state and federal government groups participating.

The study will broaden an existing program conducted by the Atomic Energy Commission's Oak Ridge National Laboratory which has been primarily concerned with health and safety aspects related to the release of low-level radioactive waste solutions to the river. ORNL will continue its current program of surveying and sampling to assure that the concentrations of radioactive material in the river are below established limits for drinking water.

The new program, a comprehensive study of the Clinch River downstream from the Oak Ridge area, will determine the dispersion and ultimate fate of radioactive materials, evaluation of any potential direct or indirect effects of liquid waste disposal activities, and evaluation of the usefulness of the river and similar streams for waste disposal purposes.

The ecological aspects of the program are designed to study the role that river plant and animal life has on the ultimate distribution of radioactive materials, and to provide information on basic aquatic biology. The study is expected to include a survey of fish.

Low-level radioactive liquid wastes are released to the Clinch River from ORNL at White Oak Creek. The waste solutions come from the Laboratory's research and chemical processing activities and have been processed through a waste treatment plant prior to discharge to the creek.

Waste solution having a higher radioactive content are stored at the Laboratory in huge underground storage tanks, while intermediate level waste solutions are stored in large seepage pits which permit the activity to decrease and to become fixed in the ground. Eventual seepage from the pits goes through White Oak Creek.

The new joint research program is being conducted under the supervision and guidance of a steering committee representing the participating organizations. Organizations involved in the study in addition to ORNL are: AEC; Tennessee Game and Fish Commission; Tennessee State Health Department; Tennessee Stream Pollution Control Board; Tennessee Valley Authority; U. S. Geological Survey; and the U. S. Public Health Service.

Cease and Desist Mine Disposal of Sewage

Pennsylvania's Water Board recently took legal action to compel Kingston (Luzerne County) to stop drilling bore holes in abandoned mines for the disposal of sewage.

Walter A. Lyon, director of the Sanitary Engineering, said that the state health department's Division of Dauphin County Court was requested today to issue an injunction to restrain Kingston and the contractor from drilling the bore holes "or doing any other construction work in connection with the borough's sewer system until the defendants apply for and receive a Sanitary Water Board permit and comply with the Clean Streams Law."

Huntington was the scene of . . .

West Virginia's S. I. W. A. and A. W. W. A. Section Meetings

West Virgina Sewage and Industrial Wastes Association members met at the Prichard Hotel, Huntington on March 23-24, 1960. It was announced that the new name would be West Virginia Water Pollution Control Association. Voting in October, 1959 on the name change was contingent only on the change made official at the Federation Dallas meeting.

Aerobic Digestion Plants in Ohio were discussed by Homer Knox, Ohio Dept. of Health, Columbus, Ohio. Four hundred aerobic digestion plants have been approved for construction in Ohio, with approximately two-thirds of these plants installed and in operation. Basic design data for these plants were adopted in January 1958, to include one-hundred gpcd, screening or comminuting equipment, duplicate units for plants handling 40,000 gpd or more and aerators providing 24 hr. detention for average daily sewage flow. Design also requires at least 1200 cu. ft. of air per pound of BOD entering the tank per day, four-hour detention for settling, 1:1 recirculation rate based on average daily sewage flow, sewage measurement by V-notch weir or other appropriate device and sludge holding tanks providing 8 cfpc. The plants are located so that they will be isolated at least 250 ft. from dwellings. Fence is required to be included around each plant, high enough to discourage trespassers and far enough away to minimize throwing of articles into the tanks.

Because of the small sizes of most of the plants, no technical supervision is available. The plants have the advantage that they can produce satisfactory results in the absence of technical supervision. The greatest number of plants installed in Ohio are concrete tanks with diffused air equipment and are generally lower in first cost than other types producing comparable results. Operating costs are high and, when the amortized cost of operation is considered, there will be some point where aerobic digestion will not be economical. This factor is not often considered by real estate developers who are interested mainly in first cost. Largest plant for which plans have been approved by the Ohio Dept. of Health is the 350,000 gpd plant for the village of Canal Winchester.

Operating problems indicate that daily attention should be given to insure that all equipment in the plant is operating. The most frequent cause of trouble is clogging of air lift devices used for sludge return. This can usually be remedied quickly, but will adversely effect plant effluent if allowed to continue. Scum sometimes accumulates on settling tank surface and should be skimmed off and disposed of, not returned to the aeration tank. Foaming occurs at nearly every plant when initially placed in operation; however, foaming ordinarily ceases when solids content is built up in the aeration tank. Where foaming has continued, inexpensive spray devices operated with plant effluent have taken care of the problem. No complaints have been received regarding odors from aerobic digestion plants. Chlorination is required where plant effluent is discharged to a stream passing through residential or built-up areas.

Flexible Joints for Sewer Pipe were described by W. D. Kelley, consulting engineer, Charleston, West Virginia. Perhaps the greatest drawback in the use of cement-asbestos and vitrified clay pipe has been the lack of satisfactory joints though many types have been tried. In recent years, clay pipe manufacturers have developed a truly flexible resin joint carrying ASTM tentative specifications C 425-58T. Several types are presently available and judged acceptable based on the use of PVC polyester O-rings and similar materials. Lubricants and solvent combinations are often used on the jointing surfaces, and 6", 8" pipe requires only the use of a crowbar to compress the joint.

The principle advantage of the flexible joints are their ease of installation, though slightly higher in first cost than poured joint pipe if accumulated dirt and grit are removed to make clean surfaces. A permanently tight joint results which resists tamping, backfill and roots. Since pipe represents a minor cost of a sewer system, when ditching, pavement repair and manholes are considered, Mr. Kelley believes the extra cost of pipe due to good joint selection is negligible by comparison. These joints will flex from 1 to 5 degrees to make gentle curves where required.

Biological Oxidation of Organic Chemical Wastes in Stabilization Basins was reported by W. M. Steinfeldt, Eastman Kodak Company, Rochester, New York and Jack T. Garret, Monsanto Chemical Co., St. Louis, Missouri. Wastes capable of being treated by oxidation are probably amenable to oxidation in a stabilization pond. Winter operation provides difficulties due to freezing, with attendant spring release of anaerobic odors. High color is not removed in the type of pond described, the design of which depends on local topography and land availability. Oxidation is accomplished in part by algae, bacteria, protozoa and some higher animals. Design basis for stabilization ponds depending on

the type of waste may be 50 lbs. of BOD per acre per day. Ponds can stand overloads better than activated sludge or trickling filter plants, according to this report.

Operator's Forum

Removal, Sedimentation, and Chlorination was discussed by H. W. Pitts, Jr., Supt. Parkersburg Sanitary Board. Grit removers should be located ahead of any lift pumps in the system, and the grit channel should be cleaned to keep velocity at or near the mean designed rate. Area and location for grit disposal depends to a great extent on the quality of the grit, whether high or low in organic material. Sedimentation offers few problems; however, design fixes the capacity of the plant and provides for the removal of settled sludge. Removal of scum and floating material should be done regularly if manual and mechanical equipment should be regularly maintained. Use of caustic cleaning materials are suggested to remove accumulations of grease in lines and skimming pans. Chlorination is practiced for disinfection and odor control, pre-chlorination removes sulfides, but upsewer chlorination is more often easier said than done. Ortho-dichlorobenzene has been used occasionally to control odors in collection systems. Mr. Pitts suggested the use of plant effluent to operate chlorinators and discussed operation of chlorination equipment.

Sludge Digestion was discussed by R. A. Bush, Parkersburg Sewage Treatment Plant. Elimination of the use of telescoping sludge equipment was reported, and sludge removal is controlled using a vacuum gauge on the pump suction pipe operating within a range of 25 to 2 readings on a gauge. By multiplying the length of pumping time by the pump rate, an approximation of pump sludge volume can be made.

Secondary Treatment, T. K. Bruce, Bluefield Sanitary Board, reported the use of chlorination for odor control along with sunning, which is accomplished by turning off the distributors periodically to allow filter surfaces to come partially dry. He cautioned, influents should not be over-chlorinated.

Sampling and Laboratory Control by G. W. Ehlen, Moundsville Sewage Treatment Plant favors elimination of temperature readings in sewage treatment plants as well as the total solids determination in primary plants. He reported that digester control is greatly facilitated by the use of the volatile solids analysis. Adequate records on digester pumping as well as control on material being pumped contributes greatly to efficient digester operation.

West Virginia Section, A.W.W.A., held its 22nd meeting, also in Huntington, and two of the papers featured were concerned with the Ohio River Valley and its related water problems. Other topics discussed included a comparison of the water systems of other countries with our own, the causes of exterior corrosion of metal water pipes, and West Virginia chlorination practices.

Orsanco and Ohio River Quality was discussed by F. W. Montanari, Ohio River Valley Water Sanitation Commission, Cincinnati, Ohio. Thus far, thirteen billion dollars have been spent in the Ohio River Valley to improve water quality management. The efforts resulting from twelve years of work have established sewage treatment plants for 95% of the population located on the Ohio River's main stem. Industrial wastes treatment is deficient, with only 80% of the contributors meeting the basic requirements and 64% presently adequate. Challenge is therefore up to industry to reduce contamination and control concentrations of chlorides, oil and mine drainage.

Water quality monitoring is now being accomplished by 44 stations, reporting data from over thirty locations. The Aquatic Life Resources Project reports increasing locations and numbers of fish in the river. Radioactive monitoring and taste and odor studies continue to be carried on.

Why Paints Fail was the subject of an illustrated lecture by E. J. Sirmay, Tropical Paint Company, Cleveland, Ohio. Typical paint failures were discussed together with suggested ways of avoiding them. It was pointed out that too much paint is nearly as bad as no paint, good thickness being .012" applied on a clear surface from which rust and mill scale have been removed. Where unique situations are to be encountered, for example mildew in high humidity areas, specific paint formulations should be purchased for the application.

Radial Collection Wells in Ohio River Gravels were discussed by H. K. Gidley, and J. H. Millar, both of Charleston, W. Va. The presentation summarized results from a questionnaire forwarded to all industrial firms and one municipality in West Virginia known to have a radial collector well (Ranney method), or wells, in operation. A one-hundred per cent reply was obtained prepared by high-level management and technical personnel in each organization. There are eleven Ranney type wells in operation in West Virginia which have been installed since December, 1952. All wells are located along the Ohio River between Wheeling and Huntington. Based on information submitted by the well owners, the safe yield of collector wells may be somewhat less than the reported initial yields. Survey shows capacity losses after several years operation vary between 30 and 50%. Some of the wells have been redeveloped for reasons varying from resilting to investigating possible source of water with improved mineral content. Construction of navigation dams on the Ohio River will raise normal pool levels for long stretches of the

river. This should increase the yield of wells located adjacent to such pools. Progress in dam construction is slow, and many years will have elapsed before completion of the proposed dams.

Value of Water Systems in Stimulating Progress in Undeveloped Countries was discussed by E. G. Wagner, International Cooperation Administration, Washington, D. C. The community water supply program launched by the International Cooperation Administration with the World Health Organization and Pan-American Health Organization is cooperating with sixty countries throughout the world who request it. The United States and host country technicians work jointly on an agreed upon program. The objective is to develop an environment and institutions which will generate the continuous and progressive solution of problems by the host country itself. This applies to solution of present problems and laying the groundwork for solving future problems. Major problems are to develop the public and official interest and to develop educational and training facilities. Formal in-service training and staff preparation programs are important, as are new sources of financial aid and pilot projects for demonstration, training and investigation. Progress is being made; however, it is difficult to analyze. Compared with the United States' progress, there is a definite need for additional emphasis on a world wide basis.

Chlorination Practices in West Virginia by J. E. Rosencrance, West Virginia State Dept. of Health, Charleston, West Virginia. Chlorination was first begun in West Virginia by application at Bluefield in 1914. Progress has been made from 1911 when only 22% of the public water supplies in the state were being disinfected, with rapid increases during the period 1915-1920. Organization of the Division of Sanitary Engineering in 1915 encouraged the increase. Steady increases were followed until, of the 503 public water supplies in West Virginia, approximately 1.088 million people are being served. Of these, 296 submit operating reports and 207 do not regularly submit reports and may, therefore, not be receiving adequate treatment. Efforts are being made by the Div. of Sanitary Engineering to bring the latter supplies under closer supervision and assure consumers of a safe supply. County health departments have been included in training sessions, a program which is beginning to show results. Ten hypochlorinators have been installed in two southern counties on public systems never previously chlorinated. It is anticipated that the program will continue progress to the extent that continuity of adequate treatment will be assured. In most of the smaller water supply systems, chlorination is the only treatment practiced. In the larger systems where complete treatment is utilized, pre and post-chlorination may be used, and chlorine in combination with ammonia is used at several plants. Chlorine dioxide is used at Nitro, Wheeling, Weirton among other plants whose raw water includes heavy industrial pollution.

Exterior Corrosion of Water Lines was discussed by H. W. Hetzer, Union Carbide Chemicals Company, South Charleston, West Virginia. Distribution system corrosion is often evidenced by repair of leaks without serious consideration as to cause and its mitigation. Insufficient emphasis has in the past been placed on the effect of corrosion on underground metallic pipes. Corroding of buried lines is an attempt by the metallic pipe to return to the state in which it existed prior to having been manufactured into its present form. This occurs in the presence of oxygen, aided by moisture in its installed location. The process of metallic corrosion is the electrolyte in which the ions travel. In a pipe system, corrosion will occur wherever current leaves the pipe. Where current returns to the pipe, the pipe will be protected. Deposition of hydrogen at this point may produce an insulating effect by adding resistance to this part of the circuit. Polarization of this type will be upset if a supply of oxygen is available in the surrounding soil.

Corrosion rate is dependent on several factors: magnitude of current flowing, chemical composition of the electrolyte, concentration of the electrolyte, and amount of oxygen available. Electromotive and galvanic series tables are excellent guidance tools for those who design underground structures as well as for those who must investigate or mitigate corrosion. Utility men often have unintentionally produced the galvanic cells that destroyed their underground structure. The economic loss as a consequence of the thoughtless combination of metals is inexcusable, when knowledge regarding corrosion and its mitigation can, now, be readily obtained.

Potomac Saved From Dulles Airport Sewage Wastes

No sewage effluent will be discharged from Dulles International Airport into the already badly polluted Potomac River or its tributaries pending the construction of a permanent interceptor sewer line from the airport to the District of Columbia sewage system.

The Federal Aviation Agency and the Public Health Service have agreed on a plan to treat the sewage wastes at the airport, thus preventing sewage effluent from entering the river for the next three years.

The President has directed the Bureau of the Budget to transmit to the Congress proposed legislation authorizing the construction by the District of Columbia of a sewage system which would provide a full, permanent regional solution to the sewage disposal problem at the airport and the adjacent communities in Maryland and Virginia.

This legislation would authorize the District of Columbia to prepare plans for the permanent system and would authorize the appropriation of $3,000,000 as a Federal contribution toward its share of the system. This money would provide funds for plans and specifications for the system, for the acquisition of rights of way, and for the construction of a trunk line connecting the airport with the system. The legislation would also authorize the District of Columbia to borrow as much as $25,000,000 from the Treasury to build the system.

Some novel thoughts in the mathematics of an interesting phenomenon are in . . .

A New Method for Calculating K and L for Sewage

by REMO NAVONE, Chief
Branch Public Health Laboratory
Los Angeles, Calif.

EDITOR'S NOTE: The determination of values for K and L, the BOD oxidation rate constant and the ultimate BOD have been of fundamental interest almost since the time the concept of BOD was introduced. Various methods have been developed over the years each improving our ability to determine these values. In this contribution from the Division of Laboratories of the California State Department of Public Health, a new method which utilizes quite simple calculations and does not require any special charts or curves is presented. The data are divided into two roughly equal groups from which the values for use in two simultaneous equations in two unknowns are obtained. The values are determined by averaging and summing the daily results. Solving the two equations gives values for K and L. Results obtained by this method compare very well with those obtained by the older methods.

■ ONE OF THE OBJECTIONS in measuring biochemical oxygen demand of sewage and other wastes is to ascertain the effect these wastes will have on the oxygen content of the receiving waters. In addition to the oxygen-consuming capacity of the waste another factor needs to be known, namely the rate at which this oxygen consuming capacity is exerted.

The monomolecular equation in the form $y_t = L\ (1\text{-}10^{-Kt})$ has been applied as a first approximation to measure the BOD exertion with time [1]. To determine the rate of oxidation at any time, t, the above equation is differentiated with respect to t:

$$\frac{dy_t}{dt} = K\ (L\text{-}y_t) \qquad (1)$$

where,

$\frac{dy_t}{dt}$ = rate of oxidation

L = ultimate oxygen demand
K = oxidation rate constant (natural logarithms)
$L\text{-}y_t$ = amount of material remaining to be oxidized

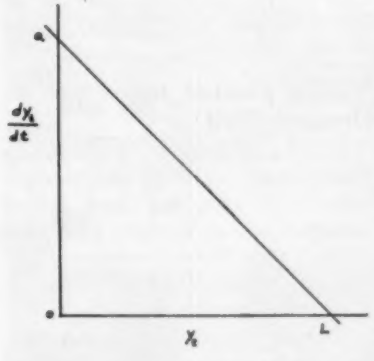


FIG. 1. THE CURVE of $\frac{dy_t}{dt}$ vs y_t showing the values of a and L.

y_t = measured BOD at time t

This equation may be written as:

$$\frac{dy_t}{dt} = KL - Ky_t \qquad (2)$$

If $\frac{dy_t}{dt}$ is plotted against y_t a straight line may be drawn as indicated in Fig. 1.

The slope of this line or the oxidation rate constant K, is equal to $\frac{\frac{dy_t}{dt}}{L - y_t}$

and also from the figure:

$$K = \frac{a}{L} \text{ or } a = KL$$

Where: a = intercept on ordinate axis
L = intercept on abscissa and is also the ultimate first stage B.O.D.

This paper presents a simplified calculation for obtaining the constants, a and K of Fig. 1 which will make the algebraic sum of the distances of the plotted line from the observed points equal to zero. To do this it is necessary to divide the BOD data into two nearly equal groups. For example in Table I take the first five days as one set of data and next four days as the other set of data.

Table I
BOD Data

t (days)	y_t	$\frac{dy_t}{dt}$
0	0	—
1	157	114.5
2	229	64.0
3	285	40.0
4	309	31.5
5	348	25.0
6	359	11.0
7	370	9.5
8	378	2.5
9	385	4.0
10	386	—

If y_t represents the observed BOD values at twenty-four hour intervals then $\frac{dy_t}{dt}$ is obtained as follows:

$\frac{dy_t}{dt}$ for first day = y_t on third day minus y_t on first day / 2

$\frac{dy_t}{dt}$ for second day = y_t on third day minus y_t at zero time / 2

$\frac{dy_t}{dt}$ for third day = y_t on fourth day minus y_t on second day / 2

These calculations are carried out in this manner until $\frac{dy_t}{dt}$ has been determined for each day.

If in equation 2, a is substituted for KL since KL = a, we have:

$$\frac{dy_t}{dt} = a - Ky_t \qquad (3)$$

Summing data for first five days from Table 1 and substituting in equation 3 we have:

$$275 = 5a - 1328\ K \qquad (4)$$

in a simular manner for the next four days we have:

$$27 = 4a - 1482\ K \qquad (5)$$

Equations 4 and 5 are solved simultaneously, leading to:

K = 0.461 and a = 178. The oxidation rate constant K in common logarithms is equal to:

$$\frac{K}{2.303} = 0.20$$

The ultimate oxygen demand $L = \frac{a}{K} = 386$ mg/l

Table 2
Comparison of Results

	Proposed Method	Slope Method	Method of Moments
k	.19	.20	.20
L	391	389	390
k	.20	.21	
L	386	386	
k	.17	.16	.16
L	324	329	328
k	.09	.10	
L	2.9	2.8	
k	.11	.11	.12
L	70	69	69
k	.18	.21	
L	585	569	
k	.12		.13
L	2.8		2.7

Table 2 lists values of k and L on various samples of sewages calculated by three different procedures. It is seen that the method discussed in this paper compares favorably with the values obtained by the Thomas Slope Method[2] as well as the Methods of Moments developed by Moore, et al[3].

References

1 Reed, L. J., and Therault, E. J., The Statistical Treatment of Velocity Data *Jour Phys Chem* 35, 673, (1931); 35, 950 (1931).

2 Thomas, H. A., Jr., The Slope Method of Evaluating the Constants of the First-Stage Biochemical Oxygen Demand Curve *Sewage Works Journal* 9, 3, 425 (1937).

3 Moore, Edward W.; Thomas Jr., Harold A., and Snow, William Brewster, Simplified Method For Analysis of B.O.D. Data *Sewage and Industrial Wastes* 22, 1343 (1950).

Jordan Associates Have New Address

W. Alec Jordan, Associates, have recently made the announcement that they have moved their firm to the following address: 230 Park Avenue, New York, 17, N. Y.

Melcher Wins Award for Outstanding Paper on Water

Frank W. Melcher, Senior Staff Chemist, Water Treatment, Analysis and Research of the Coca-Cola Company, Atlanta, Ga., has received the Outstanding Paper Award by the Society of Soft Drink Technologists.

E. S. Hopper, supervisor of the Central Laboratory of Bottler Product Control and Research Department of The Coca-Cola Company, tied with N. H. Coanen of American Can Company and John K. Shaw of Charles Pfizer and Co. for second place in the competition.

The subject of the award-winning paper, presented at the Society's 1959 meeting in Washington, D. C. is "Keeping Sand Filters Clean." It details Mr. Melcher's observations of methods by which sand water filters can be operated to utilize their top performance in obtaining superior water purity, a vital factor in the soft drink industry. The paper was first published in the Proceedings of the Society's 1959 meeting.

Mr. Melcher is the first person to receive this Award, established in 1959 by the Society as recognition for the paper making the best contribution to soft drink technology during the year preceding.

Mr. Melcher received his degree in chemistry from Oberlin College and has been with The Coca-Cola Company since 1943. He is also a member of the American Chemical Society, American Institute of Chemists, and the American Water Works Association.

Wilbar Elected to Orsanco Post

Dr. C. L. Wilbar, Jr., Pennsylvania State Health secretary and Sanitary Board chairman, has been elected vice-chairman of Orsanco (the Ohio River Valley Water Sanitation Commission). He will succeed Ross H. Walker on July 1.

The election was held at the regular spring meeting of the commission at White Sulphur Springs, W. Va. Orsanco is the interstate agency responsible for pollution control of the Ohio River and its tributaries.

Manual of Septic Tank Practice

It is estimated that several million dollars each year can be saved by an improved method of constructing household septic tank, sewage disposal systems.

Described in a recently released Addendum to Public Health Service Publication No. 526, the method, through an improved underground absorption trench system, eliminates the need for a distribution box and reduces the possibilites of failure in such systems.

This Addendum is called, the Manual of Septic-Tank Practice. The FHA has already adopted the method in their minimum property requirements for FHA insured homes which use septic tank systems.

Single copies of the Addendum are available from the Public Inquiries Branch, Public Health Service, Department of Health, Education, and Welfare, Washington 25, D. C. The Manual and the Addendum may be purchased from the Superintendent of Documents, Government Printing Office, Washington 25, D. C. The price is 35c a copy.

A multiplicity of independent sewage districts are a part of . . .

Denvers Sewage Disposal Problem

by W. McWILLIAMS
Technical Writer

EDITOR'S NOTE: The growth of Denver and its environs has produced a slightly different twist to the problems usually associated with urban expansion. The problems of overloaded treatment plants, areas developing faster than facilities, and the others with which we are all too familiar are present here also. In addition Denver has the unusual situation of having 57 separate sanitary authorities in the five counties which make up greater Denver. These authorities operate some 26 treatment plants in their areas. This number of treatment plants and sewage authorities would not be strange in an area where ridges broke up the terrain. Denver however is blessed with a topography which would permit the collection by gravity of the sewage of the entire area at one or at the most two central plants. As a solution to their problem a metropolitan sewage treatment district is proposed for the entire area of greater Denver. The district would begin its operations by building a large central, complete treatment plant which would handle the effluents of the individual plants which could not meet the new state law requiring complete treatment. Those districts which could comply with the law economically would continue operations. As the individual district's plants become too costly to operate and maintain they would be abandoned and the load taken up by the metropolitan authority. It is expected that this plan will provide adequate sewage treatment at a fraction of the cost of maintaining, building and expanding the plants of the individual districts.

■ ONE OF DENVER'S newspapers recently carried a facetious cartoon showing a group of privys marking the city's skyline. A sign designated them as sewer districts and the caption ubiquitously placed the situation in all parts of town.

Such incidents point up a problem existing in the Metropolitan Denver area's sewerage facilities. There are 57 separate sanitary authorities in the five counties making up greater Denver, and 26 sewage facilities in the same area.

Denver's sewerage system, Denver's future and growth, Denver's very life depends upon a traditionally difficult water supply. The water shortage which has, at times, been acute is the result of an average rainfall of only 14 in. and a population growth of 27.5 percent in a six year period. Since 1936, it has been necessary to transport water from the western slope, across the continental divide to the city. Water is recognized as the state's most valuable natural resource.

Today, reservoirs are at more than 85 percent of capacity and the amount of water available in the average year from Denver Water Board facilities has been materially increased over the past five years.

In 1951 the Denver Board of Water Commissioners circumscribed the city with what was known as the Blue Line. This line defined the area which Denver could serve with water under the conditions which existed. The original feeling was that the Blue Line would not be discontinued until a new and additional supply could be delivered through a tunnel reaching from the Blue River to the eastern slope. However, the Blue Line was removed January 1, 1960. When the Harold D. Roberts Tunnel and the Dillon Dam are completed in 1962, an additional 150 thousand acre feet of water will be available to Denver in the average year.

Long range plans are being entered

FIG. 1—THE CLARIFIERS at the existing Denver North Side plant

FIG. 2.—THE NORTH SIDE PLANT'S grit chamber and preaeration basins

into for the correction of the sewerage deficiencies which were also brought about by the spectacular population increase. Part of the preparation of these plans was an exhaustive and comprehensive survey of the Denver area's sewerage systems, sewage problems, and sanitary needs, prepared by Black and Veatch. The report was compiled in 1957, and states that for the best interests of everyone concerned, a consolidated sewage authority should be formed to serve the city and its surrounding communities.

Since that time, efforts have been made to bring all the interested communities together in a mutual betterment program. The main objections to efforts to accomplish this inter-urban cooperation have to do with time and money already expended by some of these communities to solve their own problems individually and a moral obligation they feel to correct sewage conditions immediately without waiting for the implementation of the overall plan. Throughout the parts of the Black and Veatch report, which describes each of the existing sewage facilities in the area, a common phrase is noticed being repeated. "Overloaded. The effluent will not meet the requirements of the Colorado State Department of Health."

A Colorado State Law, known as the Wells Law, regulates the operation of treatment plants. It states that municipal and industrial sewerage systems, whether the effluent is discharged into the surface or ground waters, must not have a BOD in excess of 50 mg/1 unless the receiving watercourse is used downstream as a source of domestic water. In this case the allowable maximum BOD shall be 30 mg/l. Also the effluents shall not contain suspended solids exceeding 75 mg/1, shall not contain substances in quantities toxic to man, shall not contain floating matter and finally shall not contain settleable matter exceeding 0.5 ml/1.

In addition to these regulations, the Water and Sewage laws of 1955 governing the Colorado State Department of Public Health state: "Streams, lakes and other waters shall be kept free of pollution".

Faulty Facilities Prevail

The Denver area, approximately 364,000 acres, is all tributary, either directly or by minor watercourses to the South Platte River which runs through the center of the city. Sanitary sewage is conveyed to the North Side treatment plant by a gravity type collection system.

The North Side Sewerage plant is the main plant serving Denver. It is located to serve the city proper and several outside tributary areas. The largest of these is Jefferson County, west of Denver, the fastest growing of the five counties involved. In this area west of the tributary to Denver, are eleven sanitation districts, several communities, subdivisions, federal and local agencies.

The North Side plant is designed to provide primary treatment for an average flow of 85 mgd. It presently receives an average of over 60 mgd. The plant consists of a venturi meter, bar screens, grit chambers, preaeration chambers, six primary clarifiers, a chlorine contact chamber for post chlorination, eight separate heated digesters and sludge drying beds.

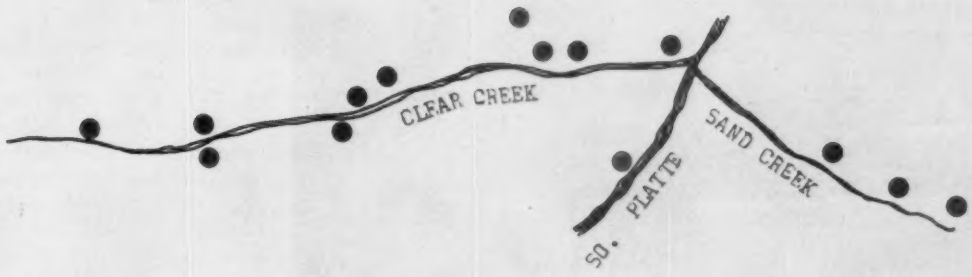
The report made to the city by Black and Veatch recommended secondary treatment facilities be added and capacity be raised to 110 mgd at this plant. The Colorado State legislature also enacted a law in 1959 requiring complete treatment. The total cost of plans drawn up by the Intercounty Regional Planning Commission and the Joint Sanitation Commission to accomplish this complete treatment has been estimated at about 24 million dollars.

The other sewerage facility in Denver is the East Side treatment plant. This plant has capacity to treat 4.5 mgd but receives only an average 1.0 mgd. Abandonment of this plant is being considered with new trunks sewer to by-pass it and convey the sewage to the North Side plant.

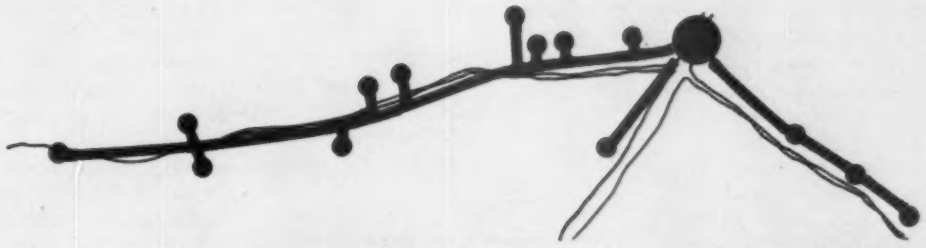
Sewage treatment plants and districts in the area to the North and West of Denver include a North Washington Sewage treatment plant, located well to the north of the city amid industrial establishments and packing plants. To the North and West is the Arvada Sanitation district, providing complete treatment, but operating at near capacity. Another, known as Baker which is located a mile and a half north of Denver has an unfavorable site for expansion or improvement. The Clear Creek Valley Water and Sanitation District, Wheatridge Sanitation District, Fruitdale Sanitation District, Northwest Lakewood Sanitation District and Golden are all to be found north and/or west of Denver. While some of these plants produce satisfactory effluent, most of them are unsatisfactory.

m s t d

METROPOLITAN SEWAGE TREATMENT DISTRICT IN A NUTSHELL

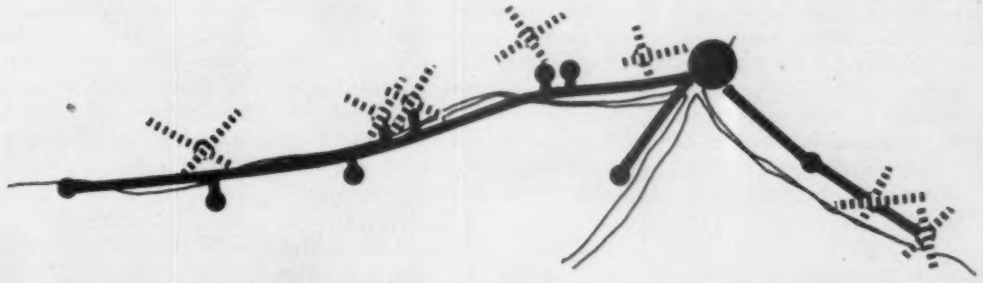


AT PRESENT .. there are 57 sanitation districts and 26 treatment plants in the Denver metropolitan area .. 22 districts with 14 plants in the Clear Creek - Sand Creek portions alone. Of all districts operating treatment plants, only one meets all state health standards. The plants of other districts are either incomplete, overloaded, or wholly inadequate. New state law requires complete treatment. As the population grows (see next page), all districts face expensive construction programs if they try to "go it alone".



THE PLAN:

1. Leave all existing sanitation districts to continue building and operating local sewer lines and operating any local treatment plants that are economical.
2. Create a METROPOLITAN SEWAGE TREATMENT DISTRICT (MSTD) to build a large complete treatment plant and trunk lines.
3. MSTD would receive raw or inadequately treated sewage from any local district. It would charge rates proportional to the amount and strength of sewage.



IN THE FUTURE .. Gradually abandon small local treatment plants as they become uneconomical to repair and operate. Complete treatment in a metropolitan plant would cost HALF AS MUCH. During the next twenty years of metropolitan growth, the savings would be.....ENORMOUS !

FIG. 3—SOME OF THE MATERIAL used to bring the Metropolitan Sewage Treatment District plan before the public

FIG. 4—DIGESTERS at the North Side Plant

Southside Situation Similar

The areas to the Southwest and South of the city including Bear Creek, which may be one of the next residential areas to be developed on a large scale, has similar conditions. So does the town of Morrison which is served largely by septic tanks, the Federal Correctional Institution, Fort Logan and the Colorado Industrial School for girls. Although the southerly municipalities of Sheridan, Englewood and Littleton are adequately served by recently rebuilt or new plants, the Glenn L. Martin plant, the Ramo-Wooldridge plant, Bowmar Sanitation district, the town of Castle Rock, and the Cherry Creek area have situations similar to that described in the North and Northwest.

To the east are Fitzsimmons Army Hospital, Altura sanitation district, the Naval Air Station, and Aurora. Here capacities are not what could be desired and expected population growths will aggravate the problems in these areas.

In addition to these conditions, still another community, known as Glendale, is demanding the right to connect with Denver's system in the south. Denver is reluctant to allow this until Glendale, with a population of 600, agrees to annexation. Finally, an area described as South Lakewood has voted sewage bonds to build a sewage plant in their area. Construction of such units is the reverse of the plan of consolidation recommended and sought after by Denver officials, but South Lakewood residents cite the prospects of having to help pay for Denver's system as their reason for individual action.

Conditions such as these in one of the nations three fastest growing metropolitan areas, gives justification for concern and supply the reason for the urgency that Denver's City engineers are placing upon consolidation. It is predicted that greater Denver, with a population of just over 700,000 in 1956, will grow to 900,000 by 1962 and to a million and a half by 1980.

Consolidation Considered Critical

There is much in favor of the plan of consolidation and much against the construction of many small units. The cost difference is recognized by virtually all authorities to be overwhelmingly in favor of the consolidated metropolitan sewerage authority. Congress also provides an incentive for such cooperation with federal aid to be used for plant construction.

An enabling act, passed by the Colorado legislature, is needed to permit the formation of a metropolitan sewage treatment district composed of the existing cities and sanitation districts in the Denver metropolitan area. Such legislation was requested in the January 1960 session of the State legislature by a group of 22 state senators. The enabling bill is now pending.

Meanwhile, the Inter-county Regional Planning Commission and the Joint Sanitation Commission are forging ahead with a workable plan to provide trunk-line collection and complete treatment of all sewage. The plan will leave all existing sanitation districts to continue building and operating local sewer lines and operating any local treatment plants which are economical, while a Metropolitan Sewage Treatment District is created. This treatment district would then build a large complete treatment plant and the trunk lines to feed it. The treatment district would receive raw or inadequately treated sewage from any local district. Gradually, as the district's large complete treatment plant began to serve the surrounding areas and as the small local treatment plants in these areas became uneconomical to repair and operate, the latter would be abandoned.

Three new trunk lines are included in the plan. One would run up the Clear Creek Valley from the Platte River to Golden (West of Denver). A second would follow the Sand Creek Basin from the Platte River to Aurora (East of Denver). The third would follow the Platte River (nearly through the center of Denver) to the North Side primary-treatment plant.

Ultimately, the large complete-treatment plant would be constructed at the confluence of Clear Creek and the Platte River, North of Denver. This plant would be large enough to completely treat all sewage from the districts in the three areas. Eventually, the district could be enlarged to provide similar services to other parts of the metropolitan area, such as Englewood and Littleton in the south.

From an engineering standpoint, the Denver sewerage system is unique among systems of its magnitude. With only one exception, it can be arranged so that the entire sanitary sewer system can flow by gravity to the North Side treatment plant. The city is fortunate "in that the early engineers had foresight to plan the Denver collection system to handle the tremendous growth which has taken place during the past two decades. It is the intent of the administration to continue a far reaching attitude in its planning for the continued growth of the sewage collection and treatment facilities of the area."

Denver's first sanitary sewer was constructed in 1881. Since that time, the North Side sewage treatment plant was constructed to serve all of Denver, and more than 1100 miles of sewers have been built.

Taking its cue from the National A.W.W.A. . . .

Hammond, Indiana "Does It Now"

AN example of planned progress in Waterworks development.

Keeping in step with the A.W.W.A.'s suggestion two years ago that local water companies institute a "Do It Now Program", the City of Hammond, Indiana's Water Department initiated its own expansion program that has resulted in positive accomplishments. Not only has the Department tangible improvements to show for its efforts, it also can proudly (and deservedly) boast that all of the improvements have been, and are being, paid for out of current operating revenues.

Among these improvements are:

the construction of a garage addition which doubles their previous garage area, at a cost of $32,000;

the renovation of their rapid sand filters by removing the sand and gravel from the filter tanks, and by replacing this material with new sand and gravel, at a cost of $32,000;

the purchase of 100 feet of frontage (about 1 acre) of land adjacent to their distribution maintenance shop, at a cost of $9,000;

and the completion of plans for the installation of water transmission mains during 1960, at a cost of approximately $600,000.

Open House Held

But that's not all. The Department has just held an "Open House", March 26, to dedicate its latest improvement, a $130,000 Commercial Office Building. Mr. Casey Brock, President of the Board of Trustees, welcoming the guests, said that the "Open House" was an opportunity for the Board to say "hello" to the many water users in the Hammond area and to show them an example of the Department's continued progress.

Many of the city officials from the Calumet region visited the new building, and more than thirty Water officials from various parts of the state were present. The Hammond Water Department furnishes water services to all Hammond residents and to the towns of Lansing, Ill., Highland, Ind., and Munster, Ind.

Mr. Brock was the Presiding Officer of the day. Among the speakers were: Hammond Mayor, Edward C. Dowling; Mr. Leo Louis, Past Chairman of the Indiana Section, A.W.W.A., who is Vice President and General Manager of the Gary-Hobart Water Co.; and Mr. L. L. Murphy, President of the Hammond Chamber of Commerce.

"Open House" was held recently to dedicate this $130,000 Commercial Office Building by the Hammond, Ind., Water Department. This is the latest of their "Do It Now" program.

THE latest in modern construction and design for maximum efficiency.

The new building is a fire retardant structure of 3,825 sq. ft., with a full basement. The construction consists of a waterproofed poured concrete foundation; exposed face brick solid masonry exterior walls, with the exception of the aluminum curtain wall on the north elevation; a long span joist roof construction supported on masonry and fireproofed steel columns; a poured gypsum roof deck with an insulated built-up roof; and an incombustible metal acoustical ceiling.

The flooring is asbestos-vinyl in the office areas; terrazzo in the entry and washrooms and lobby, and painted plaster and oak finish in the offices. Another feature is recessed lighting equipped with prismatic glass lenses. The structure is heated by a gas-fired hot water boiler which also heats the other two buildings on the property. Year-round air conditioning is provided.

The building was erected under the direction of the Water Board; James M. Turner was the architect and Charles G. Crary and Sons, Inc., was the general contractor.

Where Do We Go From Here And When Do We Start?

The old saw "Wish I'd said that" was never truer than today. In the philosophical discussion about "Our Changing Environment", PHS's Frank A Butrico and Russell W. Hart write elsewhere in this issue as many would wish to have written. To be sure, the comments have been heard before, perhaps even written before. But this appraisal seems to strike closer at home, coming as it does early in a decade demanding real progress.

The facts are that we are not prepared for adequate rebuttal to criticism about what we are doing and what we plan to do about destruction of non-living air and water-borne environmental contaminations. If this is true, and we believe that it is, what's to be done about it? Assuming we identify a new non-living contaminant, can we do anything about it? Are we equipped with sufficient capable manpower, the necessary techniques, tools and tenacity to combat it?

"Our Changing Environment" hints at one of the major problems: "—approximately 60 out of an anticipated total of 250 sampling stations in the Water Quality Network have been established—" for sample examination. "Local laboratories are performing conventional chemical analyses. The more complex examinations are made by the Public Health Service." It becomes obvious that most water treatment plant laboratories can not really study water quality. Requirements are rigid both in equipment and personnel, too rigid, in fact, for most of the 18,000 U. S. water supplies. And yet water supplies, particularly surface supplies, receive many types and varying amounts of contaminating materials. It is comforting to review the record and contemplate our successes to date. Such contemplation, unfortunately, often allows complacancy to creep in.

Complacancy cannot be afforded, even though precious time is used up reviewing the record. The time must be used in acting now to expand on our record and establish procedures, techniques, personnel procurement policies and information exchange procedures which are specific to solve immediate problems. Flexibility must permit adaptation to future circumstances. Presumably, the Water Quality Network evaluates water quality beyond a shadow of a doubt. If deterioration or contamination becomes evident, again presumably, positive corrective action would be forthcoming. A recent plating waste spill caused several southeastern Michigan municipalities to close their Raisin River supply intakes. Fortunately, the spillage was properly and promptly reported, permitting warning of the utilities concerned. Stream sampling followed the course of the spill and provided data on which to resume pumping.

The question arises as to whether water utilities should be prepared for any living or non-living contamination, or whether they should reply on spillage reports and the evaluation of their own water quality by others. Whether by design or indifference, the latter course of action prevails. Also, if a contaminant creeps in, even though identified, should the plant be equipped to dispose of it, other than by dumping downstream? Under any circumstance we find ourselves faced with deciding where we go from here, and perhaps more important, when do we start?

Calcite Coating for Water Pipes

This month's Research Progress Report has all the earmarks of a process ready for application. Ready that is, after some willing and capable operators have subjected it to field trial on their systems. That the system works on hard well water has been demonstrated beyond a shadow of a doubt.

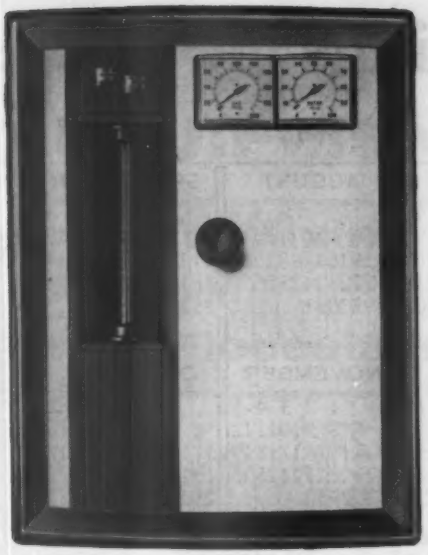
Professor McCauley is the first to admit that "further field testing with a number of waters is essential to define the optimum levels of polyphosphate, Driving Force Index and Momentary Excess" which is necessary during the initial two hour coating period. Further, he is looking for additional information on the level at which these important factors should be carried in distribution systems to maintain and enhance the protective coatings. Volunteers are needed to establish the burden of proof required and at the same time preserve their distribution system from further deterioration.

The road to successful and widespread application of many new ideas has historically been fraught with difficulties, frustrations, apathy and unfortunate delay in adoption. The system for red water and pipe corrosion prevention described by Dr. McCauley is probably no exception to this precedent. First introduced in 1957, the theory has received only passing attention. Interest has been maintained by the National Institutes of Health through continuation of research grants. While this activity is commendable, the lack of interest, or apathy, on the part of the majority of waterworks men is downright depressing.

Analysis of the theory and conversion of the procedures to useful application are not difficult. Neither are costs prohibitive. Application of the system requires only use of those techniques which should be practiced in every waterworks laboratory for routine control. It is interesting to note that process control "is best accomplished by a continued monitoring of the calcium level". Use of the conventional EDTA calcium determination for this purpose, plus total hardness and alkalinity checks simplify the procedure beyond description. Considering that 1000 feet of main can be coated in two hours, no long term assignment of personnel would be required in most cases.

The calcite coating can be laid down over surface defects within the pipe. The coating process, to be successful requires that pipes be cleaned free of tubercles and encrustation. For systems whose carrying capacity is reduced, friction losses high and the complaint department busy, the requirement for clean pipes is quite obviously a blessing in disguise.

It remains for interested technicians everywhere to sit up and take notice of ideas and devices which contribute to their efficiency and provide the means to make economical operational improvements. It is difficult to understand why nearly three years have passed since announcement of this development and so little interest has been taken in it. Problems of the type encountered in distribution systems do not normally solve themselves. Solution to the widely prevalent red water problem appears now to be at hand, with thus far no takers. If you have the problem, give the system a try, then report your results so that others can learn from your experience. You might even get a compliment from the one that counts the most—your customer.



This, believe it or not, is a wall mounted chlorinator. Its attractive appearance is our way of showing how proud we are of the advanced operating parts hidden behind the front panel. For example: This is the first wall mounted chlorinator ever to feature a single stack regulator. Simple, compact appearance belies the fact that it can handle up to 200 pounds per day of chlorine more accurately, dependably, and safely than any other chlorinator with the single exception of its big brothers. It is so completely corrosion-proof in the right places that we have little hope of ever selling replacement units. In short, we have never been happier with any product than we are with the new Series 3600 chlorinators.

Should you wish to order one of these beauties sight-unseen, on our say-so, we can deliver immediately from warehouse stocks across the country. If not, your local F&P field office will gladly demonstrate the 3600 Series at your plant, at your convenience. Call for an appointment. Or, write for complete information in Bulletin 70C3600. Fischer & Porter Company, 170 Fischer Road, Warminster, Pa.

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Meetings

1960

JULY							AUGUST							SEPTEMBER						
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July 24-Aug. 5—Columbia University (*Arden House*) Harriman Campus. NINTH ANNUAL UTILITY MANAGEMENT WORKSHOP

Aug. 10-12—University Park, Pa. (*Pa. State University*) PA. SECTION WATER POLLUTION CONTROL FEDERATION

Aug. 22-26—Boulder, Colorado (*University of Colo.*) WESTERN RESOURCES CONFERENCE

Aug. 29-31—Cincinnati, Ohio. (*Sanitary Engineering Center*) Public Health Service Symposium on Water Quality Data Collection and Utilization. Director, Robert A. Taft Sanitary Engineering Center, 4676 Columbia Parkway, Cincinnati 26, Ohio

Sept. 7-9—Watertown, South Dakota (*Grand Hotel*) SOUTH DAKOTA SECTION WATER POLLUTION CONTROL FEDERATION

Sept. 7-9—Watertown, South Dakota (*Grand Hotel*) So. DAKOTA SECTION A.W.W.A. Secy., J. Darrell Bakken, Div. of San. Eng., State Dept. of Health, Pierre, S. D.

Sept. 11-16—New York, N. Y. AMERICAN CHEMICAL SOCIETY

Sept. 12-14—Knoxville, Tenn. (*Andrew Jackson Hotel*) KENTUCKY-TENN. SECTION A.W.W.A. Secy., Harold F. Mount, Gen. Mgr., Preston Street Road Water District No. 1, 5400 Preston Highway, Louisville. Ky.

Sept. 12-14—Knoxville, Tenn. (*Andrew Jackson Hotel*) KENTUCKY-TENN. SECTION WATER POLUTION CONTROL FEDERATION

Sept. 14-16—Virginia Beach, Va. (*Cavalier Hotel*) VIRGINIA SECTION A.W.W.A. Secy: Edward H. Ruehl, R. Stuart Royer & Assoc., 15 West Cary St., Richmond, Va.

Sept. 14-16—Upper Saranac Lake, N. Y. (*Saranac Inn*) NEW YORK SECTION A.W.W.A. Secy., Kimball Blanchard, New York Branch Sales Office, Neptune Meter Co., 22-22 Jackson Ave., Long Island City 1, N. Y.

CONTINUED ON PAGE 88A

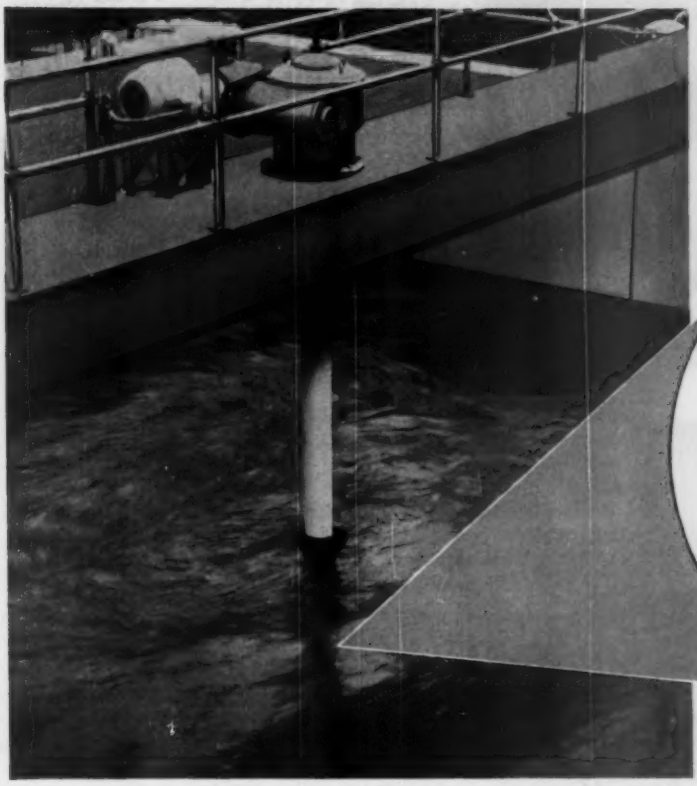
McDONALD'S 104 YEARS OF EXPERIENCE STAND BEHIND THIS PRODUCT

McDonald 4717 Curb Stop — Minneapolis pattern. Combined cap and tee handle inverted key curb stop. Both ends copper pipe couplings. Round way. Also available in stop and drain patterns. Sizes — ½, ¾, 1, 1¼, 1½ and 2 inches. A catalog of McDonald's complete line of water works brass goods is available on request. Write to:

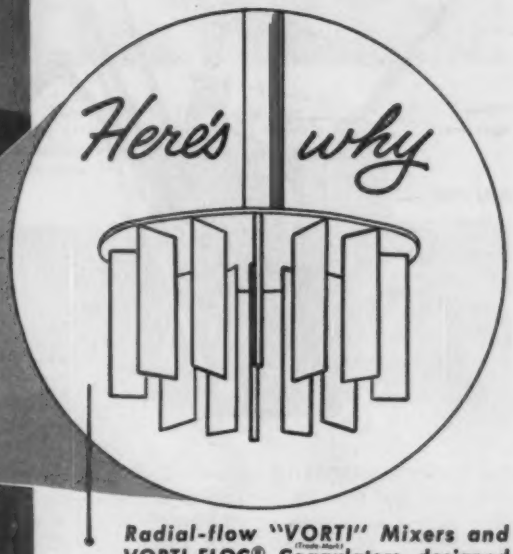
A.Y. McDONALD MFG. CO. Dept. WS-760, 12th & Pine, Dubuque, Iowa. • Brass Goods • Pumps • Oil Equipment • Drainage Products

You get better results

WITH INFILCO EQUIPMENT



for Mixing and Flocculating



Radial-flow "VORTI" Mixers and VORTI-FLOC® Coagulators, designed by INFILCO engineers, move larger volumes of liquid at lower impeller speeds than other types.

Higher efficiency at lower operating cost

"VORTI" Mixers are applicable to most problems of mixing and agitation. The impeller is usually suspended from the top of the basin without the use of underwater guide bearings, stuffing boxes or submerged chain drives.

"VORTI-FLOC" units are used for chemical treatment or for self-coagulation. They create gentle flow and turbulence by moving large quantities of liquid at relatively low velocities, thus promoting coalescence and agglomeration of suspended particles.

By proper combination of speed and size of impeller, applications of INFILCO radial flow units include:

- ***Slow stirring for equalization***
- ***Blending of liquids***
- ***Neutralization***
- ***Slow stirring for flocculation and agglomeration***
- ***Rapid mixing of chemicals in liquids***

INFILCO mixers are efficient and economical. Write today for complete details.

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The one company offering equipment for all types of water and waste treatment—coagulation, precipitation, sedimentation, filtration, flotation, aeration, ion exchange and biological processes.

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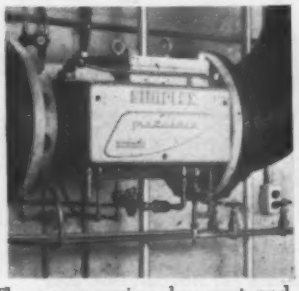
Look what you won't need with your next flow controller

NOW THERE'S A MODERN, surprisingly simple way to control flow in your filter effluent piping. The Modulair "P" rate of flow controller, fully pneumatic, installs almost as easily as a piece of pipe, gives you accuracy with less "hardware" and attention than other types of controllers.

SIMPLE! Pre-assembled unit saves you money on initial cost and installation cost. Simplicity of design reduces maintenance almost to zero. All working parts are enclosed. No hydraulic valves or valve operator. No water supply needed. No drive gears or linkage. No complicated piping. No pilot valve. No floor drain.

COMPACT! Has the shortest laying length of any rate-of-flow controller. No appendages. Shown in the picture at the right is one of three Modulair controllers at the modern filter plant in Fairmont, Minnesota. Note the trim, clean installation, with no "spaghetti" of hydraulic piping, no appendages. Unit is simply "a box on a pipe."



USEFUL, FREE BULLETIN. The space saving, low cost and operating economies of the Modulair "P" are fully detailed on the pages of our Bulletin 951. Complete specifications included. Write for a copy—with no obligation on your part.

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VALVE AND METER COMPANY
a division of PFAUDLER PERMUTIT INC.
Lancaster, Pennsylvania

Sept. 18-21—Montreal, Quebec (*Queen Elizabeth Hotel*) 1960 Annual Convention NEW ENGLAND WATER WORKS ASSN.

Sept. 21-23—St. Paul, Minn. (*Lowry Hotel*) North CENTRAL SECTION A.W.W.A. Secy., Carl A. Flack, Registrar, Water Dept., 216 City Hall, St. Paul, Minn.

Sept. 21-23—Traverse City, Mich. (*Park Place Hotel*) MICHIGAN SECTION A.W.W.A. Secy., T. L. Vander Velde, Chief, Section of Water Supply, State Dept. of Health, DeWitt Rd., Lansing, Mich.

Sept. 25-27—Jefferson City, Mo. (*Hotel Governor*) MISSOURI SECTION WATER POLLUTION CONTROL FEDERATION

Sept. 25-27—Jefferson City, Mo. (*Hotel Governor*) MISSOURI SECTION A.W.W.A. Secy., Warren A. Kramer, Chief, Water Supply, Div. of Health, State Office Bldg., Jefferson City, Mo.

Sept. 25-28—Tulsa, Okla. (*Mayo Hotel*) AMERICAN INSTITUTE OF CHEMICAL ENGINEERS

Sept. 28-30—Madison, Wis. (*Hotel Loraine*) WISCONSIN SECTION A.W.W.A. Secy., Harry Breimeister, Bureau of Engineers, 607 Municipal Bldg., Milwaukee, Wis.

Sept. 28-30—Charlottetown, P.E.I., Canada (*Charlottetown Hotel*) MARITIME BRANCH, CANADIAN SECTION A.W.W.A. Secy., J. D. Kline, Gen. Mgr., Public Service Com., Halifax, N. S.

Oct. 2-6—Philadelphia, Pa. (*Trade and Convention Center*) WATER POLLUTION CONTROL FEDERATION

Oct. 2-9—Montivideo, Uruguay (*Hotel Carrasco*) INTERAMERICAN ASSN. OF SANITARY ENGINEERING. Write: J. G. Stewart, Room 2008, 165 Broadway, New York 6, N. Y.

Oct. 5-7—Bismark, North Dakota (*Grand Pacific Hotel*) NORTH DAK. SECTION WATER POLLUTION CONTROL FEDERATION

Oct. 6—Hamden, Conn. (*Sanford Barn*) CONN. SECTION A.W.W.A. Sec., Donald W. Loiselle, Sup. of Supply, Bridgeport Hydraulic Co., Bridgeport, Conn.

Oct. 9-12—Birmingham, Ala. (*Tutwiler Hotel*) ALA-MISS. SECTION A.W.W.A. Secy., Ernest Bryan, McWane Cast Iron Pipe Co., Box 2601, Birmingham, Ala.

Oct. 9-13—Boston, Mass. AMERICAN SOCIETY CIVIL ENGINEERS

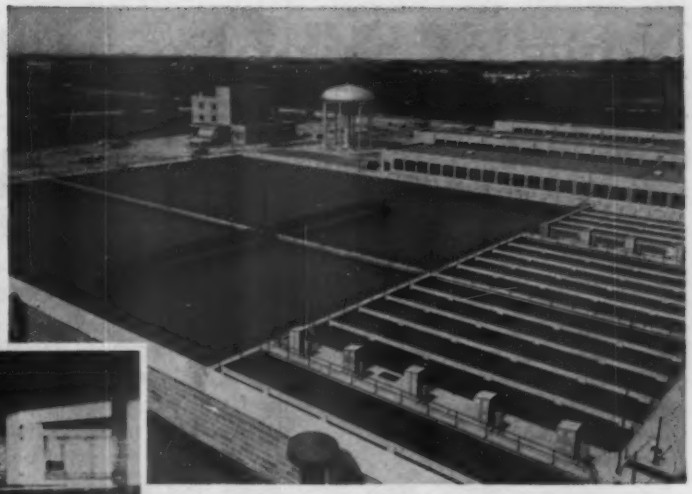
Oct. 16-19—Galveston, Tex. (*Galvez Hotel*) SOUTHWEST SECTION A.W.W.A. Secy., Leslie A. Jackson, Mgr.-Engr., Municipal Water Works, Robinson Memorial Auditorium, Little Rock, Ark.

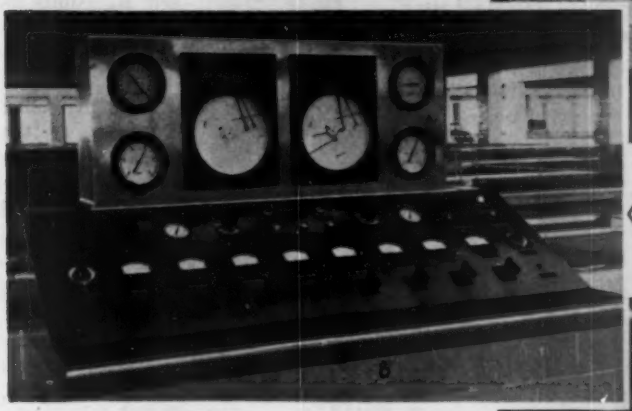
Oct. 19-21—Des Moines, Iowa (*Fort Des Moines Hotel*) IOWA SECTION A.W.W.A. Secy., J. J. Hail, Supt., Water Dept., City Hall, Dubuque, Iowa.

Oct. 19-21—Washington, D. C., (*Sheraton Park Hotel*) CHESAPEAKE SECTION A.W.W.A. Secy., Carl J. Lauter, 6955-33rd St., N.W., Washington, D. C.

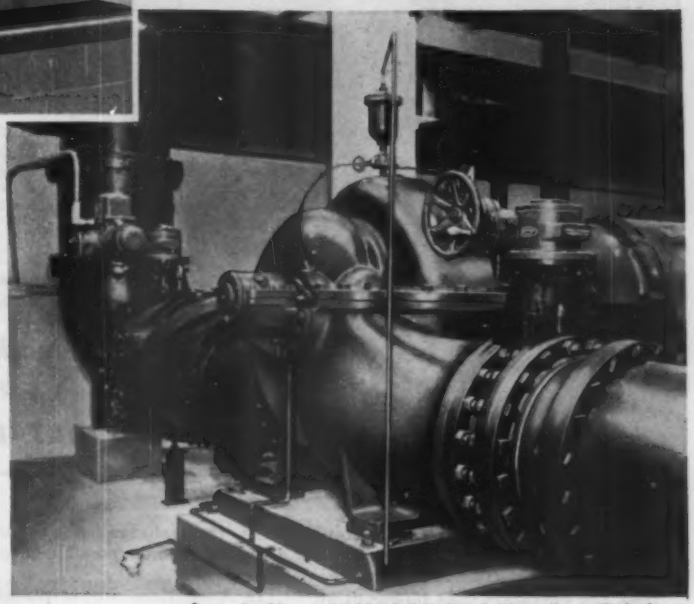
Push-Button OPERATION by LimiTorque

IN THE NEW TORRESDALE WATER TREATMENT PLANT





Twin Filter Console Table used for control of Filters and to control valve sequencing cycle during Filter Backwash—one for each twin filter unit.



Looking at 13,900 G.P.M. Wash Water Pump. Right front shows LimiTorque Manual Drive Operator on 24" Butterfly Valve (Pump Suction). Left rear: LimiTorque Valve Operator on 24" Butterfly Valve (Pump Discharge).

LimiTorque Valve Operators play a very important role in the operation of the huge Filter Building at Philadelphia's new Torresdale Water Treatment Plant . . . 94 rapid sand filter beds collectively filter river water at a normal rate of 282 million gallons daily. LimiTorque Push-Button Operators are used to start, stop and reverse automatically, various sized butterfly and gate valves which in turn control valves used in: operating the 94 rapid sand filter beds —and regulating the flow of water in the 54" backwash water header piping—valves installed range from 8" to 42" diameter. A unique feature of this new push-button plant is the use made of limit switch contact points built into the LimiTorque Operator—i.e., the sequence of control for automatic operation of filter beds is through Minneapolis Honeywell Filter Console Tables, using the torque limits (fully opened or closed) to trigger the next valve in sequence—Thus when the employee desires to wash a filter bed automatically, he merely pushes "backwash start" button, and the whole cycle of operation follows.

Most modern Water Treatment and Service Plants have chosen LimiTorque Valve Operators because of their dependable, accurate, trouble-free service, year-in year-out—Thousands are used throughout the world.

For further information about LimiTorque —consult your valve manufacturer, or your nearest LimiTorque Sales-Engineering Office —and remember, there are over 28 years of continuous designing and manufacturing experience back of LimiTorque.

THERE IS NO SUBSTITUTE FOR —

LimiTorque®

PHILADELPHIA GEAR CORPORATION

KING OF PRUSSIA (SUBURBAN PHILADELPHIA), PA.

OFFICES IN ALL PRINCIPAL CITIES

INDUSTRIAL GEARS & SPEED REDUCERS
LIMITORQUE VALVE CONTROLS
FLUID AGITATORS • FLEXIBLE COUPLINGS

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News of Suppliers

Dr. E. A. Savinelli Joins E. F. Drew & Co.

The Power Chemicals Division of E. F. Drew & Co., New York, N. Y., has announced that Dr. E. A. Savinelli has been appointed Research Director and will be responsible for the development of new and improved water treatment chemicals and processes for the company. He will be located at the Boonton, New Jersey Research laboratory.

Formerly a water consultant for four years with the DuPont Company, Dr. Savinelli has engaged in research, consulting and teaching in the municipal and industrial water treatment fields for the past ten years.

He is a graduate of Manhattan College and received his PH.D. from the University of Florida, where he developed an improved method for the removal of excess flourides from drinking water. Later, he spent a year at the Illinois State Water Survey investigating the corrosion of cast iron pipe.

Annis Appointed Aurora Pump Engineering Head

Aurora Pump Division, New York Air Brake Co., Aurora, Ill., has disclosed the appointment of Russell K. Annis as the company's Manager of Engineering.

Formerly Chief Engineer at the Kansas City works of Fairbanks Morse and Company, Mr. Annis comes to Aurora Pump with a broad background of training and experience in pump engineering.

Joining Fairbanks Morse and Company in 1949, he served in various engineering capacities and, since 1958, held the position of chief engineer of their pump manufacturing facilities in Kansas City. As a member of the Hydraulic Institute, (the trade association of the pump manufacturers), Mr. Annis has taken an energetic part in the activities of that organization.

Chicago Pump Names Anderson

Chicago Pump, Hydrodynamics Division of Food Machinery and Chemical Corporation, Chicago, Ill., has appointed William D. (Billy) Anderson Product Manager for their Ratedaeration, Small Unit Sewage Treatment Processing Equipment.

Mr. Anderson has been General Manager of the Sanitation District No. 1 of Campbell and Kenton counties (comprising 21 cities and towns in Northern Kentucky) for the past eleven years, and has served for five years as Executive Director of the Covington, Kentucky Chamber of Commerce.

He attended Purdue University (Civil Engineering) and the Harvard University Business School. As Product Manager, Mr. Anderson will replace Mr. Paul Thayer, who will devote all his time to serve as consultant on special problems.

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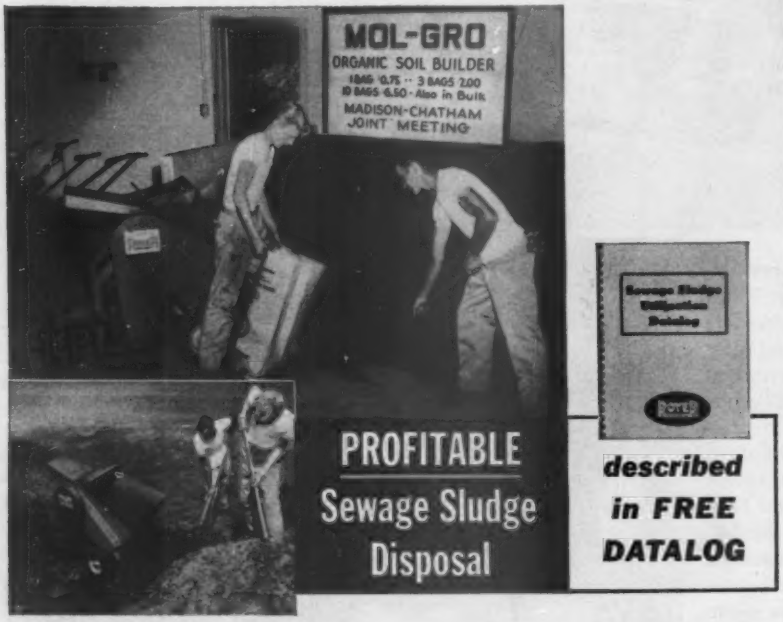


The Madison-Chatham (N.J.) Joint Meeting bags and sells their *Royerated sewage sludge cake*. While not big business, the operation does represent an additional source of municipal income.

The need for increasing municipal income, keeps growing in importance. The climate of today's economy warns against tax increases. Economies of operation are being searched for.

One of the most obvious economies that any organization can practice is the elimination of waste. Yet many sewage plants continue to dump or burn their sludge cake — throwing away or sending possible income up in smoke.

In April 1957, Royer published a new edition of their "Sewage Sludge Utilization Datalog," pointing the way to turning sewage from an expense into a profit. Since then, we've gone through two printings.

If your community is still destroying this source of revenue, write today—and learn how you, too, may experience *profitable sewage sludge* disposal.

Please send me a copy of your new edition of the information-packed "Sewage Sludge Utilization Datalog."

Name_____ Title_____

Plant_____

City_____ Zone_____ State_____

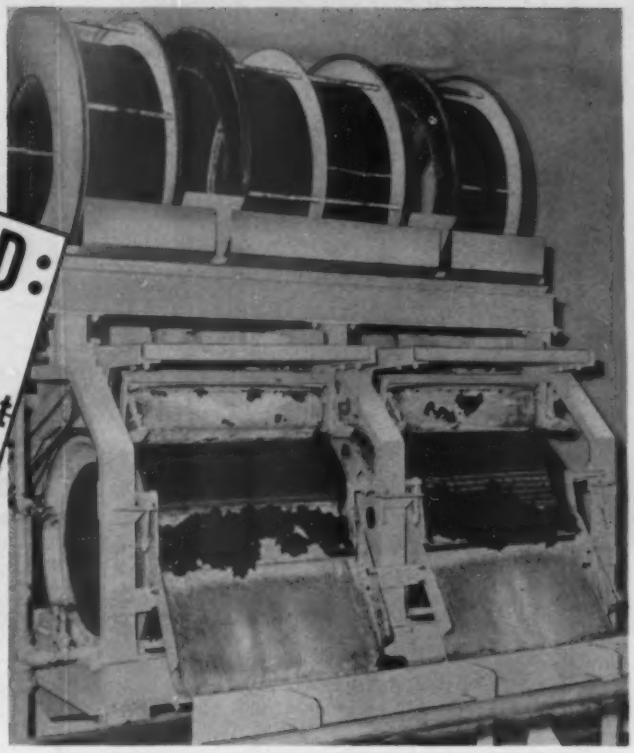
☐ I am interested in a demonstration of the Royer Shredder at work.

ROYER FOUNDRY & MACHINE CO.

ROYER

170 PRINGLE ST.
KINGSTON, PA.

NICHOLS "ROTO-PLUG" CUTS INITIAL INSTALLATION COSTS 38%



The Nichols "Roto-Plug" Sludge Concentrator with its low initial installation cost—plus its inherent efficient and economical operation—places mechanical sludge dewatering within the reach of even the smallest community.

The "Roto-Plug" eliminates expensive vacuum and filtrate equipment, chemical mixing and feeding equipment, conditioning equipment, and high filter-media maintenance. Cost-wise this is a savings of 38% of the initial capital investment, compared with other methods of sludge dewatering.

Get all the facts about the economy of the "Roto-Plug". Write today for our four-page, two-color technical bulletin RP-100.

NICHOLS ENGINEERING & RESEARCH CORP.

80 Pine Street, New York 5, New York

3513 N. Hovey Street, Indianapolis 18, Ind. • 405 Montgomery Street, San Francisco, Calif.

News of Suppliers

CONTINUED FROM PAGE 90A

Hooker to Manufacture Sodium Hexametaphosphate

The Phosphorus Division of Hooker Chemical Corp., Niagara Falls, N. Y., has announced that construction of facilities to manufacture sodium hexametaphosphate will be started in the very near future. The installation, expected to be completed by December, 1960, will be located at Jeffersonville, Ind., headquarters for the Division's four plants.

Sodium hexametaphosphate has been a commercial product for some thirty years. It is extensively used in the preparation of boiler compounds, for industrial and municipal water treatment to soften water and prevent scale formation, and also in the preparation of industrially used compounds.

Construction of the hexametaphosphate facilities will proceed simultaneously with another plant now being built at Jeffersonville for the manufacture of tetrapotassium pyrophosphate, to be completed in the fall.

control

for algae and aquatic weeds

In small amounts, Triangle Brand Copper Sulfate controls algae growth and kills some of the more troublesome aquatic weeds. They disintegrate where they are, which prevents downstream infestation or clogged waterways.

In sewage pipes, Triangle Brand Copper Sulfate can be used in such low concentrations to control root and fungus growth that surface trees remain unaffected.

Two informational booklets, "The Use of Copper Sulfate in the Control of Microscopic Organisms," and "Copper Sulfate for Root and Fungus Control in Sanitary Sewers and Storm Drains," available on request.

Phelps Dodge Refining Corp.
300 PARK AVENUE, NEW YORK 22, N. Y.

deJarnette Joins Robert & Co.

Following his retirement from the Georgia Department of Public Health as Associate Director of the Water Quality Service, March 31, Mr. N. M. deJarnette has joined Robert and Company Associates of Atlanta, Ga., in their Municipal Department.

Mr. deJarnette will continue as Secretary-Treasurer of the Southeastern Section, A.W.W.A.

C. H. Wheeler Elects Palmer As V.P.

C. H. Wheeler Manufacturing Co., Philadelphia, Pa., announced the election of Mr. Donald Palmer as Executive Vice President. He was also elected Vice President of Hamilton-Thomas which owns C. H. Wheeler.

Mr. Palmer has been with C. H. Wheeler for seven years, as Production Manager, Assistant to the President, and Vice President, Administrative, respectively. Prior to that he was Chief Industrial Engineer at U. S. Pipe & Foundry Company and Production Superintendent at the De-Laval Steam Turbine Company.

Expansion Plans Announced by Tex-Vit

Texas Vitrified Pipe Company, Mineral Wells, Texas, has announced plans for the immediate construction of new building areas to provide for additional production of vitrified clay sewer pipe.

Included in this latest phase of the company's overall expansion program will be the installation of modern horizontal-type drying rooms, a new raw materials grinding plant, a new and larger tunnel kiln, and automatic rack loading equipment for the plant's horizontal extrusion machines.

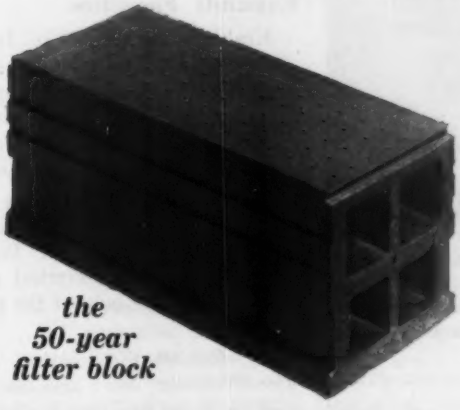
A part of the work already is in progress to make necessary changes in existing facilities preparatory to starting work on the new buildings and equipment installations. The entire project has been designed to add about 60 per cent more capacity to present production of vitrified clay pipe, and the plant is equipped to make clay pipe in diameters of 4" through 36", up to five-foot lengths.

Company officials pointed out that the new additions of production

CONTINUED ON PAGE 94A

WILL TUBERCULATION CLOG YOUR FILTER BOTTOMS?

It can't happen with Leopold Glazed Tile Blocks



the 50-year filter block

Banish concern for tubercular growth when you install Leopold . . . the 50-year glazed tile filter bottoms. The smooth surface of Leopold blocks offers no toe-hold for growth that restricts filtration and wash distribution. Individual Leopold blocks can't corrode or absorb water either, and they're acid and alkali resistant. Performance-proved in over 500 plants throughout the country, both for new and for rehabilitation projects, they require no supporting concrete structures and need only a shallow depth of small-sized filter gravel. Specify Leopold for long-term economy and minimum media maintenance. Write today for facts and figures.

F. B. LEOPOLD CO., INC.

ZELIENOPLE, PA.

Exclusive Canadian Representative: W. J. Westaway Co., Ltd. Hamilton, Ontario

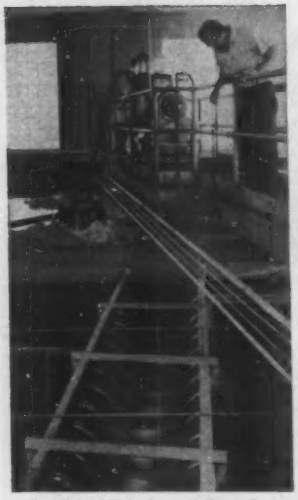
F. B. LEOPOLD CO., INC.
Zelienople, Pa.

☐ Please send literature on Leopold Glazed Tile Filter Bottoms.
☐ Please send literature on complete line of Leopold products.

Name_____

Affiliation_____

City_____ Zone____ State_____



Consolidated Water Power & Paper Co.

Raw water color plunged from 90 ppm to 4 using

N-Sol COAGULANT AID

"Continuous application of N-Sol*, activated silica sol, enables a heavier floc to settle into the slurry pool and hopper. Without silica sol coagulant aid, settling time would be doubled and filter water wouldn't be clean" . . . Paper Mill Supt.

Water plants, industrial as well as municipal, throughout the country are experiencing economies and improved finished product because of the addition of activated silica sol in the water conditioning or treatment system.

Write for samples of "N" silicate and reactant to determine specific benefits. Jar test instructions are included.

**Prepared with our "N" sodium silicate (41°Be at 68°F., 8.9% Na_2O, 28.7% SiO_2) and reacting chemical at point of application.*

PQ SOLUBLE SILICATES

Trademarks Reg. U.S. Pat. Off.

PHILADELPHIA QUARTZ CO.

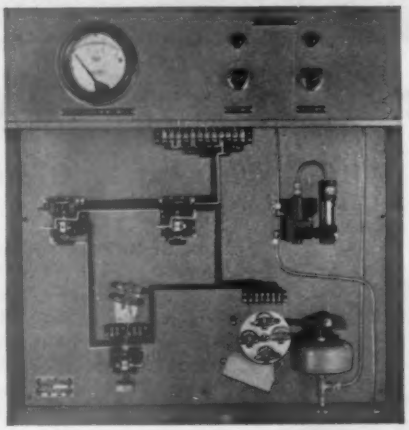
1166 Public Ledger Bldg., Philadelphia 6, Pa.

Associates: Philadelphia Quartz Co. of Calif. Berkeley & Los Angeles, Calif.; Tacoma, Wash.; National Silicates Limited, Toronto & Valleyfield, Canada

PRESSURE-OPERATED SUMP CONTROL

The RPS Rototrol is a pressure-operated sump control for starting and stopping pumps discharging out of a wet well. It is practical and dependable for either raw sewage or clear water—wherever accurate control of level is required.

The RPS is unaffected by changes in conductivity or build up in sludge. Has no moving parts in the wet well. Can be located anywhere. Requires only pressure connection between control and wet well. Operates from plant air or separate air compressor.



For full details, write for Bulletin RPS.

FLOAT CONTROLS—Healy-Ruff also makes a complete line of float-operated controls. Rototrol 940 permits each pump, up to 10, to have several starting and stopping positions. RF2 controls up to 8 pumps in sequence. Type 151 provides single pump control. Automatic alternator or transfer plugs available optionally.

Write for descriptive literature.

HEALY-RUFF COMPANY

783 Hampden Avenue • St. Paul 14, Minn.

First in dependable controls for waterworks and sewage—since 1929.

Remote supervisory controls • Complete system controls. Elevated tank controls • Sump controls • Hydropneumatic tank controls • Float controls • Alternators • Alarm silencers • Protective devices

News of Suppliers

CONTINUED FROM PAGE 92A

space and automated processing equipment represented another step in an improvement program started about three years ago. At that time, a modern office building addition was erected to house the administrative, departmental, and general sales offices of the firm. This was followed by an expansion of production facilities which included installation of new horizontal and hydraulically-operated vertical pipe presses, as well as a new plant for producing factory-cast clay pipe joints.

Davy Receives Nichols Appointment

Nichols Engineering & Research Corporation, New York, N. Y., announces the appointment of Thomas E. Davy as Manager of its Filtration Division. Mr. Davy previously was Secretary and Manager of the Customer Service Department of Komline-Sanderson Engineering Corporation with whom he was associated for the last nine years.

In his work with Nichols, Mr. Davy will deal with both municipal and industrial waste applications.

Kraloy Plastic Pipe Expands Facilities

Kraloy Plastic Pipe Co., Inc., Los Angeles, Calif., has opened new general offices and manufacturing facilities in Santa Ana, California. In Dallas, Texas, Kraloy also opened a new district office and warehouse.

The Santa Ana plant gives Kraloy one of the largest plastic extrusion facilities in the country. Polyvinyl Chloride pipe and electrical conduit will make up the bulk of the production.

Mr. Russell W. Johnson, Kraloy Vice-President, when announcing the opening of the two new facilities said they were the nucleus of a nationwide expansion program. The new buildings are located at 402 W. Central Avenue, Santa Ana, California and 8815 Diplomacy Road, Dallas, Texas.

Photo above shows how easy it is to apply the Christy contour gasket around on ALOXITE porous plate . . . forming tight joints between plates, as in insert.

Contour gasket forms positive seal between ALOXITE® plates—without cement

A new, simplified method of installation adds a further "plus" to the many advantages of ALOXITE aluminum oxide plates for rapid filter bottom construction. The method utilizes a synthetic contour gasket, easily fitted around each plate. A bead in the gasket insures tight joints continuously.

By eliminating jointing with cement or asphaltic compounds, installation time is greatly reduced. Effective sealing no longer depends on care in applying cement or attention to temperature and consistency. Pores cannot be clogged, as sometimes happens, by cement slopping over on the plates. When necessary, individual plates can be readily removed or replaced without breakage or damage to the rest of the bottom.

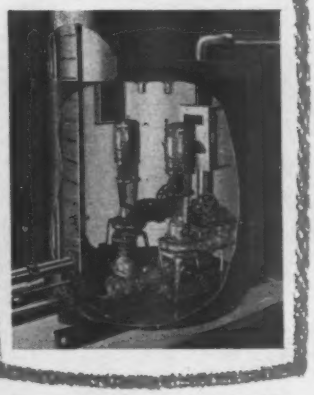
These contour gaskets are sold for about 50¢ each by Christy Firebrick Company, 506 Olive Street, St. Louis 1, Missouri. They are available from stock.

For information on ALOXITE porous underdrains, write Dept. X-60, Refractories Div., The Carborundum Co., Perth Amboy, N. J.

For time-tested porous media, count on . . .

CARBORUNDUM®

NOW... FROM TEX-VIT



A PACKAGED PUMP STATION THAT MEETS all YOUR REQUIREMENTS

- **ADVANCED DESIGN FOR GREATER EFFICIENCY**
  Compare motor and pump assembly of this duplex sewage pump station with any other and see the TEX-VIT superiority. Individual shaft for each pump and each motor. Four bearings per assembly instead of two. Heavy, corrosion protected steel shell.
- **DIRECT PRESSURE CONTROLS FOR EXTRA RELIABILITY**
  Exclusive TEX-VIT controls are actuated by pressure variation within the wet well. No compressor; no floats or other moving parts in the wet well.
- **IMPROVED AIR CIRCULATION AND CONDITIONING**
  Extra large blower provides complete change of air every 60 seconds. Air inlet and outlet are at opposite sides of station to prevent short circuiting of air. Refrigeration-type dehumidifier.
- **SUPERIOR COMPONENTS FOR EXTRA DEPENDABILITY**
  Pumps, motors, controls, and other components bear the brand names you would expect to find in a *Who's Who of American Industry*. You know you get the best when you specify TEX-VIT.
- **INSTALLATION TESTED AND PROVED**
  TEX-VIT packaged pump stations are setting new standards. Names of municipal and industrial users furnished on request.

Let TEX-VIT help with your sewage lift problems.

Write for bulletin No.W-7

TEX-VIT SUPPLY COMPANY
MANUFACTURING DIVISION
Dept. W-6, Box 117, Mineral Wells, Texas

New Bulletins

AVAILABLE FREE

Turbine Type Blowers

711

Spencer Turbine Co., Hartford, Conn., is offering a new bulletin that describes the company's line of turbine type blowers designed for sewage treatment applications.

Included in the bulletin are photographs and pertinent technical and application data. A description of the unit, with accompanying cut-away drawing, and typical job specifications are also provided.

Measurement and Control Systems

712

Industrial Nucleonics Corp., Columbus, Ohio, is offering a 28-page booklet describing the company's measurement and control systems. The booklet is primarily designed to explain the application of the AccuRay Density Analyzer to sewage treatment operations.

The importance of this type analysis, its operational advantages, economic considerations, and details of the density analyzer itself are described and illustrated. Applications of the instrument are pictured, and charts provide further pertinent data.

Non-Clog Sewage Pumps

713

Peerless Pump Division, Food Machinery and Chemical Corp., Los Angeles, Calif., has issued an 8-page bulletin describing the company's line of vertical dry basin and horizontal type, non-clog sewage pumps. These units range in capacity from 100 to 7000 gpm, have horsepower ratings from 1 to 100 h.p., can lift sewage from 12 to 70 feet, and may be equipped with electric or fuel powered motors.

Photographs and construction diagrams, as well as general specification data, further illustrate and describe the pumps.

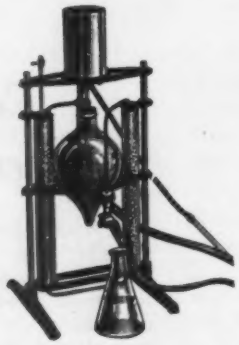
CONTINUED ON PAGE 98A

the nameplate of dependability...

MECHANICAL EQUIPMENT BY ROBERTS FILTER MFG. CO. DARBY, PENNA.

ENSLOW

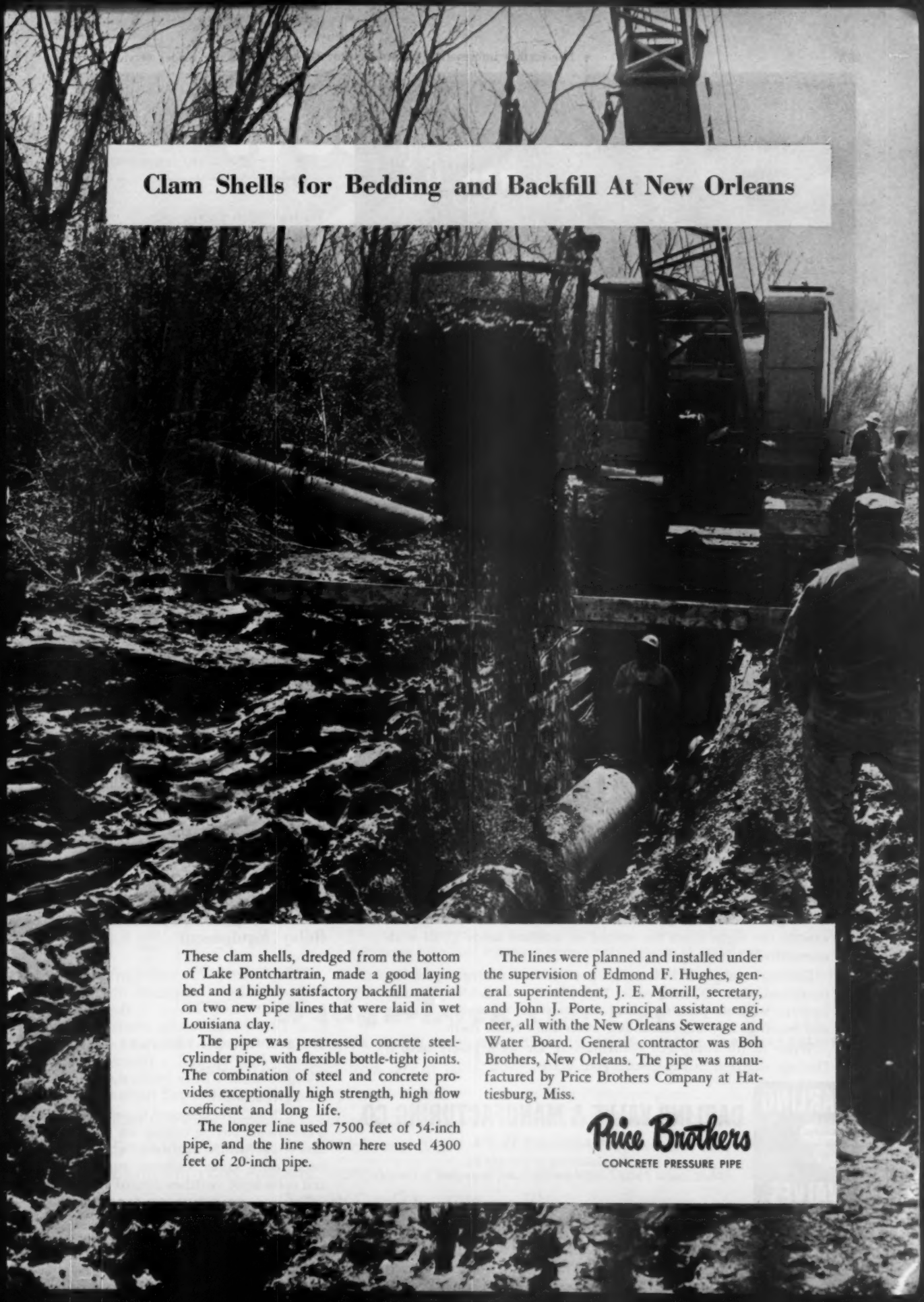
STABILITY INDICATOR



For checking the equilibrium of a finished water, and supplying an index useful in controlling anti-corrosion treatment. Catalog No. 83-895

WRITE:

Phipps & Bird, Inc.
P. O. Box 2V Richmond 5, Va.



Clam Shells for Bedding and Backfill At New Orleans

These clam shells, dredged from the bottom of Lake Pontchartrain, made a good laying bed and a highly satisfactory backfill material on two new pipe lines that were laid in wet Louisiana clay.

The pipe was prestressed concrete steel-cylinder pipe, with flexible bottle-tight joints. The combination of steel and concrete provides exceptionally high strength, high flow coefficient and long life.

The longer line used 7500 feet of 54-inch pipe, and the line shown here used 4300 feet of 20-inch pipe.

The lines were planned and installed under the supervision of Edmond F. Hughes, general superintendent, J. E. Morrill, secretary, and John J. Porte, principal assistant engineer, all with the New Orleans Sewerage and Water Board. General contractor was Boh Brothers, New Orleans. The pipe was manufactured by Price Brothers Company at Hattiesburg, Miss.

Price Brothers
CONCRETE PRESSURE PIPE

DARLING HYDRANTS

provide exactly the right type for special or unusual service needs

Above you see some of the many types of hydrants in the complete Darling line. With this wide selection, your system can include *exactly* the right types for special or unusual needs... all with unmatched Darling quality.

Darling's unique B-50-B design provides *ball-bearing* operation combined with "O" ring seals. This provides a packless, dry-top hydrant with no packing gland maintenance. Operating threads and bearings *stay* lubricated and water can't reach them.

Write us for complete information. Or we'll gladly have a Darling engineer call to discuss your needs.

DARLING VALVES

DARLING VALVE & MANUFACTURING CO.
Williamsport 11, Pa.
Manufactured in Canada by
The Canada Valve & Hydrant Co., Ltd., Brantford 7, Ontario

New Bulletins

CONTINUED FROM PAGE 96A

Water Meter Settings

714

Ford Meter Company, Wabash, Ind., has recently released a 34-page booklet entitled, "The Engineering of Water Meter Settings", specifically designed to cover a subject that so far has been improperly neglected. Thus, the publication has been primarily aimed at the concern and interest of water utility managers and engineers.

In addition to the textual coverage of this topic, numerous diagrams of meters in different installations are provided. The booklet is divided into three main sections: The Engineering of Water Meter Settings; Sizing of Water Meters and Service Lines; and, Suggested Specifications for Meter Settings.

Root and Fungus Control for Sewers and Drains

715

Phelps Dodge Refining Corp., New York, N. Y., has published and is offering a 24-page booklet that explains the use of copper sulfate for root and fungus control in sanitary sewers and storm drains.

Besides discussing specific problems and applications, the booklet also contains information relative to general root and fungus conditions occurring in sewer and pipe installations and the method of overcoming this obstacle. Pictures of disintegrated and affected pipe are presented.

Low Voltage Control And Relay Equipment

716

The General Electric Company, Plainville, Conn., announces the release of its 1960 edition of the Buy Log. The 84-page catalog covers low-voltage distribution equipment and is issued jointly by G.E.'s Distribution Assemblies and Circuit Protective Devices Departments.

The booklet is designed to serve as a condensed buying catalog for products of the two Departments, light and heavy duty safety switches, tumbler and open-knife switches, hinged wire-

CONTINUED ON PAGE 100A

Wedge-Lock®

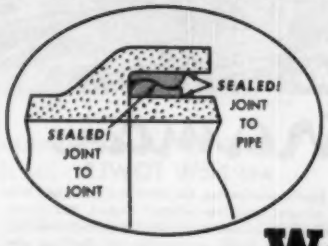
THE JOINT
with the

Full Circle
OF
PROTECTION

MINIMUM INFILTRATION!

ROOT-TIGHT SEAL!

FAST INSTALLATION!



When you install Vitrified Clay Pipe with Wedge-Lock Factory-Made Joints, you leave nothing to chance. Wedge-Lock pre-cast Joints are bonded to bell and spigot . . . snap together instantly . . . seal the entire circumference of the pipe to reduce infiltration and resist roots. Always specify Wedge-Lock, your Full Circle of Protection against infiltration . . . root problems . . . job delays . . . ultimate high cost resulting from costly repairs or maintenance.

Write to listed manufacturers for literature or an actual Wedge-Lock demonstration

Wedge-Lock CLAY PIPE

THE FACTORY-JOINTED CLAY PIPE AVAILABLE NATIONALLY FROM LOCAL MANUFACTURERS

Order Wedge-Lock from any of these Vitrified Clay Pipe Manufacturers:

Cannelton Sewer Pipe Company..Cannelton, Ind.
The Clay City Pipe Company....Uhrichsville, Ohio
The Evans Pipe Company.....Uhrichsville, Ohio
Graff-Kittanning Clay Products..Worthington, Pa.
Larson Clay Pipe Company.....Detroit, Mich.
The Logan Clay Products Company..Logan, Ohio
The Robinson Clay Product Co......Akron, Ohio
The Stillwater Clay Products Co...Cleveland, Ohio
Superior Clay Corporation.....Uhrichsville, Ohio

WLC-159-165-A

GUNITE does it 2 times as fast at 1/2 the cost

"Gunite" is the modern process (sand and cement applied pneumatically) for repairing, constructing, lining:

- Reservoirs
- Dams
- Filter Plants
- Sewage Disposal Plants
- Tanks
- Stadiums
- Bridges
- Sea Walls
- Swimming Pools, etc.

Write FOR MORE INFORMATION, INCLUDING 48 PAGE "GUNITE" BOOKLET.

PRESSURE Concrete Co.

FLORENCE, ALA. 1555 Helton Street

OTHER OFFICES IN

CHICAGO, ILL. 30 W. Washington Street

NEWARK 5, N. J. 193 Emmet Street

New Bulletins

CONTINUED FROM PAGE 98A

way, circuit breakers, switchboards, motor control centers, sectional distribution centers, and all types of panelboards and busway.

The catalog includes job-application, selection, pricing and ordering information. Among the many of its features are: Selector charts for each type of product, pictorial descriptions, consolidated pricing tables, and a cross-referenced catalog number index.

Also included are ratings, weights, dimensions, standard package quantities, ordering directions and several pages of general application information.

Submersible Sewage Pump

717

The Deming Company, Salem, Ohio, has recently published an 8-page bulletin covering the firm's new Submersible Sewage Pump, called the "Demersible".

The Demersible can be quickly installed for temporary service or per-

A STANDBY ENGINE *Automatically Controlled* by SYNCHRO-START CAN PROTECT YOU FROM MAIN POWER FAILURE

In A Matter of Seconds power can be re-established by a standby engine equipped with Synchro-Start controls.

Since 1932 Synchro-Start has been manufacturing dependable controls that are operating standby power engines to provide protection for . . .

- HOSPITALS
- AIRPORTS
- PUMPING STATIONS
- PIPE LINES
- ELECTRIC PLANTS
- BRIDGES
- COMMUNICATIONS
- MILITARY CENTERS

AND MANY OTHERS

These controls are in world-wide use plus a variety of other controls manufactured for specific engine operations.

For complete information on your requirement send engine data and desired operational control.

SYNCHRO-START PRODUCTS, INC.

Since 1932

8151 NORTH RIDGEWAY AVENUE • SKOKIE, ILLINOIS

CALIFORNIA'S welcome to the world

SANTA MONICA'S

Miramar and NEW TOWER

California's World Famous Resort overlooking the Blue Pacific where Wilshire meets the sea. Twenty minutes from International Airport. 450 luxurious rooms and bungalows, all with television and radio. Complete convention facilities. Banquet rooms for up to 2,000, air-conditioned. Exciting new Venetian Room and Cantonese Room. Swimming pool . . . Beautiful grounds and landscaped gardens. Rates from $8. Write William W. Donnelly, Gen. Mgr.

Across the U.S.A. and in HAWAII

MASSAGLIA

CREST OF GOOD LIVING

JOSEPH MASSAGLIA, JR., President

Santa Monica, Calif. Hotel MIRAMAR
San Jose, Calif. Hotel SAINTE CLAIRE
Long Beach, Calif. Hotel WILTON
Gallup, N. M. Hotel EL RANCHO
Albuquerque, N. M. Hotel FRANCISCAN
Honolulu Hotel WAIKIKI BILTMORE
New York City Hotel NEW YORKER
Washington, D. C. Hotel RALEIGH
Hartford, Conn. Hotel BOND
Pittsburgh, Pa. Hotel SHERWYN
Cincinnati, O. Hotel SINTON
Denver, Col. Hotel PARK LANE

CHICAGO MIDWEST HEADQUARTERS
BOOKING OFFICE 200 E. WALTON DE 7-6344
World famed hotels—Teletype service—Television

manently set for continuous service; its controls may be located in any convenient place.

Features of both motor and pump are shown. Materials of construction are outlined in an easy-to-read table. Performance tables, dimension tables, optional equipment, installation data, and architects' specifications are all presented.

AC Magnetic Starters

718

The Clark Controller Co., Cleveland, Ohio, has issued an 8-page illustrated bulletin, that gives engineering data on Clark Type 'CY' Starters. Available in a full range of sizes from Size 0 thru 4, the starters feature sturdy construction, simplicity of design, and fast, easy maintenance.

The Clark Arc Quenching Principle, used on the Size 2, 3, and 4 starters, designed to provide greater contact life under heavy current loads and severe arcing conditions, is fully described and diagrammed. The enclosures, forms and combinations of these units for every industrial requirement are shown.

Machinery Mounts

719

The Felters Company, Unisorb Division, Boston, Mass., has recently published a 6-page bulletin that describes the company's line of machinery mounts. These consist of three basic types: Unisorb Pads, Unisorb Level-Rite and Unisorb Level-Rite "UL".

The bulletin includes data on loading ranges, vibration transmissibility, and how to use Unisorb cement to "anchor" machines when heavy side thrusts or reciprocal action is a problem. Details on a new "do-it-yourself leveling mount" are also included.

Pneumatically Actuated Valves

720

Conoflow Corporation, Philadelphia, Pa., has just issued a new bulletin covering the company's complete line of pneumatically actuated Saunders patent-type valves.

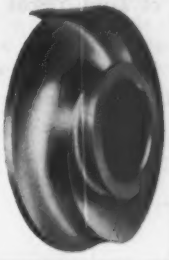
The illustrated 8-page booklet which gives construction details, operating characteristics and specifications of this Series valves, includes a section on valve sizing and flow co-efficients which aid in the proper

CONTINUED ON PAGE 102A

AURORA® CONTROLLED PERFORMANCE

NON-CLOG PUMPS

"The Pump with the single passage impeller"



MONO-VANE IMPELLER

- CAPACITIES TO 1000 G.P.M.
- HEADS TO 150 FT.
- BALANCED IMPELLER
- HORIZONTAL OR VERTICAL
- RUGGED CONSTRUCTION
- PROVEN DEPENDABILITY
- MINIMIZED WEAR
- FAST INSTALLATION
- EASY MAINTENANCE

The Mono-Vane impeller is in hydraulic and dynamic balance. It can be trimmed to suit various head and capacity requirements and still retain proper balance. The AURORA Non-Clog Pump is ideal for handling long stringy materials. Smooth, quiet operation is assured with the Mono-Vane impeller which is always in dynamic and hydraulic balance—even when trimmed to accommodate various head and capacity requirements. Single passage impeller design makes the AURORA Non-Clog pump ideal for handling long stringy materials. The discharge may be turned to any position to facilitate installation, service and maintenance. Clean-out cover is located in casing to provide easy service access.

Typical applications: elevating sewage, pumping sludge, handling heavy settleable solids, effluent, and other wastes and industrial by-products.

WRITE FOR BULLETIN 121 MV

AURORA Always PUMPS

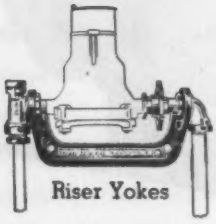
AURORA PUMP DIVISION
THE NEW YORK AIR BRAKE COMPANY
1020 LOUCKS STREET • AURORA • ILLINOIS

LOCAL DISTRIBUTOR IS LISTED IN THE YELLOW PAGES OF YOUR PHONE BOOK

Meters Play

EASY-TO-GET

when they wear **FORD YOKES**



Riser Yokes

Angle Yokes

Straight Line Yokes

Dress a meter up in a Ford Yoke and see what a difference it makes. No more fighting misalignment of pipes or wrong spacing between couplings. Just an easy twist of the wrist and you've got your meter.

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New Bulletins

CONTINUED FROM PAGE 101A

selection of the proper valve.

A complete line of close-coupled valve actuators, including the springless diaphragm, cylinder, and spring & diaphragm types for either on-off or throttling control applications, are also described.

Steel Reservoirs and Standpipes

721

Koven Fabricators, Inc., Dover, N. J., is offering a 4-page bulletin that outlines the various types and applications of the company's steel reservoirs and standpipes designed for water storage.

A table showing the comparable capacities in relation to either reservoir or standpipe sizes is included in the bulletin. Pictures of the units by themselves and on job locations are also provided.

Non-Shrink Mortar for Construction Problems

722

Masters Builders Co., Cleveland, Ohio, is offering a bulletin that explains the use of its non-shrink mortar for such construction and maintenance problems as waterproofing walls, grouting building columns, machinery and anchor bolts, caulking sewer pipe joints and patching different kinds of defects in concrete and floor brick.

Each application illustrated in the bulletin is keyed to the particular company bulletin that provides more detailed information regarding the useage of this material for the specific application described.

Centrifugal Pump Application Manual

723

Buffalo Pumps Division, Buffalo Forge Co., Buffalo, N. Y., has issued the handbook designed to acquaint users of pumps with the general forms and types of centrifugal pumping equipment and to aid them in understanding pump operation and intelligent pump selection.

Starting basically with the principles of centrifugal pump operation, the manual treats the many factors involved in handling the broad range of liquids under widely differing conditions imposed by industry's requirements today. Such considerations as viscosity effects; cavitation and suction lift; temperature rise in pumps, packing and seals, installation and trouble-shooting are discussed and illustrated.

Over fifty illustrations, charts and tables appear in the book's 227 pages $5.00 per copy, postpaid.

Laboratory Catalog

724

Fisher Scientific Co., Pittsburgh, Pa., has released an illustrated, 48-page catalog, entitled "Fisher Laboratory Specialties," which describes the many instruments, appliances, and other laboratory equipment designed in the Fisher Development Laboratories. Also described are the various apparatus for which Fisher is the exclusive distributor.

PARTIALLY ORIENTED

CONTINUED FROM PAGE 268

textbooks I returned, which would not have been the case with the equivalent amount of money spent on girls. But mentally I suffered a permanent change. I can see it by the way the rising generation ignores my advice and fails to take the slightest notice of what I say.

When I was young and hadn't passed an examination worth giving letters to, people used to listen to my opinions as being a valuable expression of the way the rising generation would set about solving some of the ills of society. But no sooner did I get myself geared up, with my professional examinations behind me and my talents tutored and organized, than nobody at all would listen to me. I find they are all too busy bending down listening to the immature squeaks of the new rising generation, who, as far as I can see, have minds as yet undisciplined by the hard grind of study for professional examinations. It is enough to make a fellow throw his notebooks away.

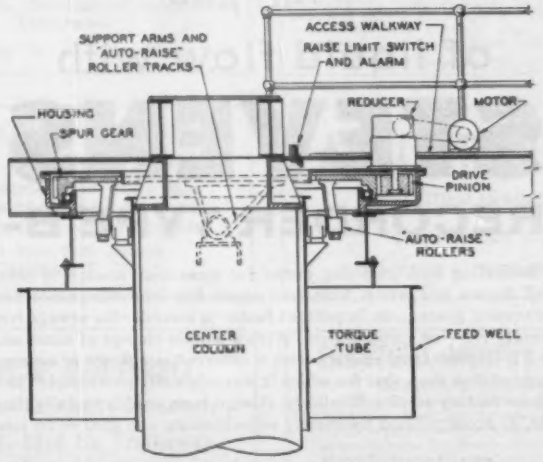
Which reminds me—where are my notebooks anyway? I might need them one day.

by Partially Oriented

PAPER MILL INSTALLS SECOND HARDINGE CLARIFIER FOR WASTE TREATMENT

The P. H. Glatfelter Company, paper manufacturers at Spring Grove, Pa., have gone a step farther in keeping wastes from its manufacturing processes out of the nearby Codorus creek. Recently, a $100,000 addition to its waste treatment plant was put into operation. It is a twin to a Hardinge Clarifier that has been in use for a number of years. Besides doubling the mill's waste treatment capacity, it helps to remove more solids from the main effluent flow.

Each clarifier is 75 feet in diameter and 15 feet deep. Together they hold nearly a million gallons and provide two hours' settling time for the main effluent on its way to the Codorus. The main waste from the mill is pumped to the clarifier as shown here. The clarifier removes fiber and clay residues from paper processing waters. The average amount taken out of the waste amounts to from 10 to 15 tons a day.



Typical Hardinge Clarifier Drive Mechanism for large, center column supported units. "Auto-Raise" feature lifts the scrapers in case of an overload, preventing breakage. Bulletin 35-D-15.

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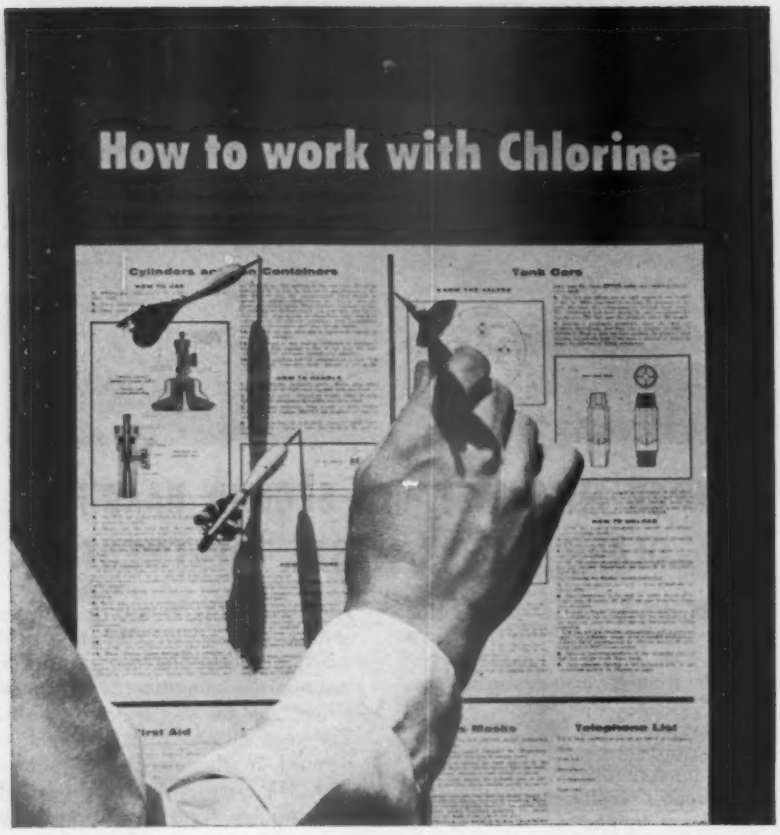

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